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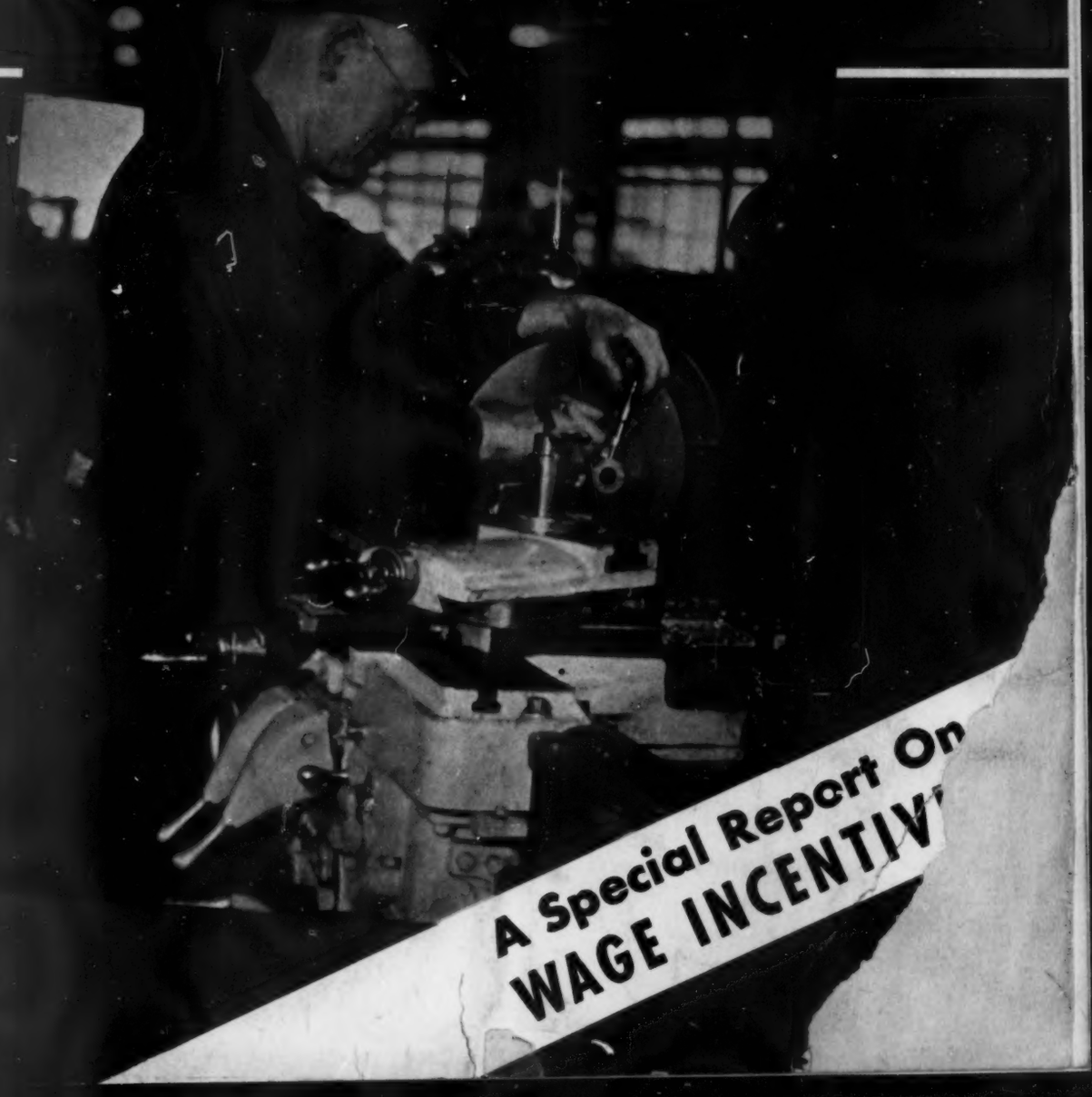

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Splitting hairs is big business nowadays...and when you can do it *automatically*...without lost motion or reliance on the human element...you've got a production advantage that can easily mean the difference between profit and loss in any internal grinding operation requiring both fine precision and high speed output. That's why practically all industries use Heald Size-Matics for grinding countless vital parts.

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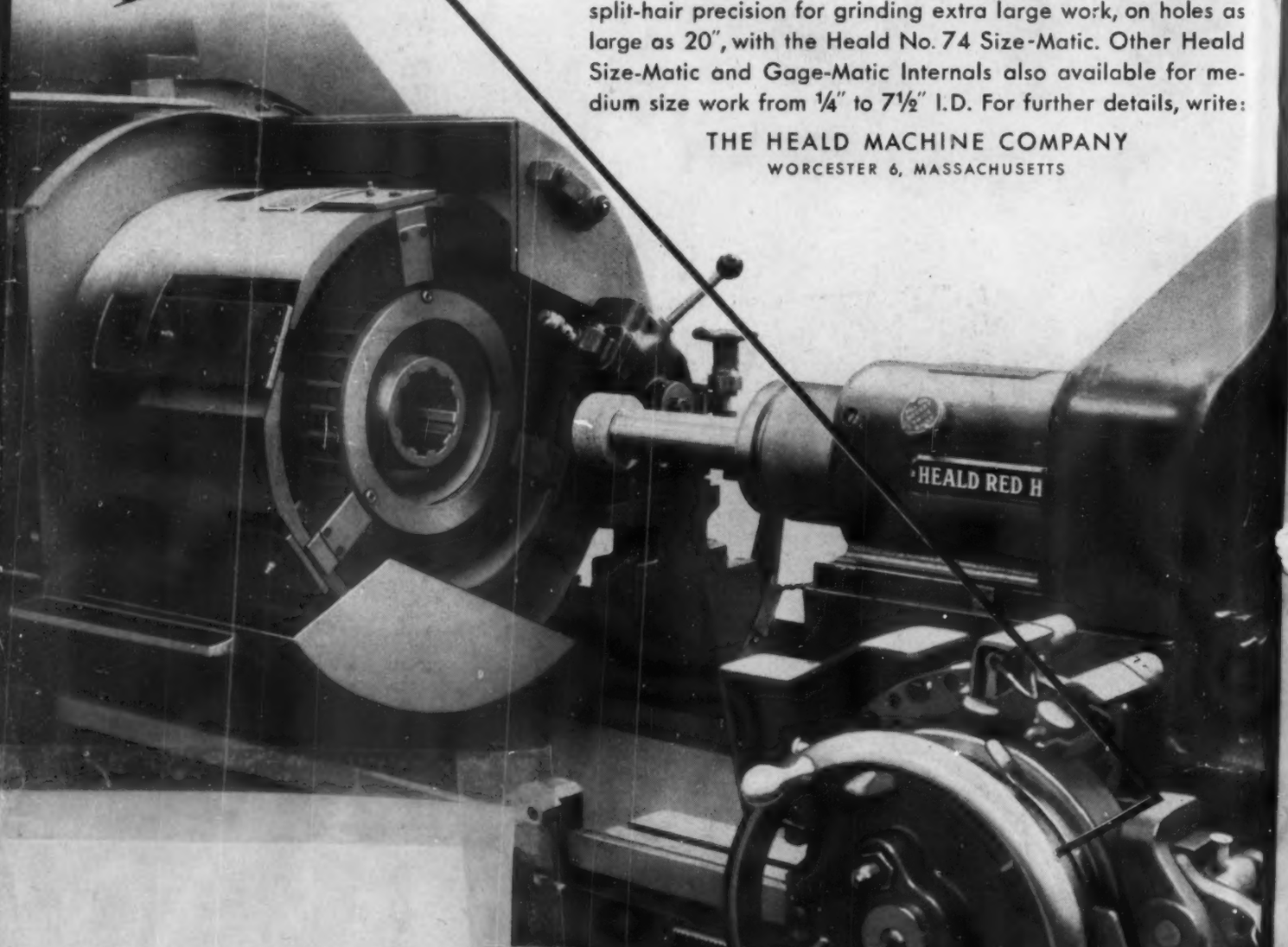

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American Machinist Chips

Big News . . . As tipped off in the previous issue, the January 17 *American Machinist* will contain the "Annual Review" of metalworking machines, equipment, materials and parts.

We are not quite sure just what the next year will bring, but we do know that in 1945 great advances were made in all types of metalworking supplies. Therefore, we believe that the alert shop executive will consider this buying reference as a "right-hand man" to be consulted throughout the year. It will contain, as you probably know, all new equipment items introduced through the pages of *American Machinist* during 1945 and as such is a veritable dictionary of the newest and best. Various types of items will be classified for easy reference.

A general summary of developments in the metalworking field, keynoting the need for modern, efficient tools and machines, will be presented and has been prepared by *American Machinist's* capable Executive Editor, Jack Haydock.

Our annual "Where-to-Buy Directory" will again be available as a separate supplement and we hope will continue to serve as an authentic year 'round buying guide for you. This directory is now in the process of being compiled and will be available pretty soon. A coupon in the next issue will make it easy for you to order one. No charge.

Fastenings . . . We recently received, and granted, a request from the Milwaukee Vocational School to reproduce material from our special section on "Selection and Application of Fastening Devices." (AM 5/24/45) We still have a respectable supply of these reprints on hand and will be glad to fill your requests. Price, 10c each.

Wage Incentives . . . In this issue we hope you will read the report on "Wage Incentives," prepared by *American Machinist* editors.

One firm which has made incentive plans really work is Reed-Prentice. They have helped to solve labor difficulties and increase production by providing that employees be paid 100% of the savings effected by their own production efficiency.

For instance, if a worker is paid ten cents for turning out a part in ten minutes and is able to complete the part in five minutes, he is paid the full ten cents. Thus, if he is able to produce two parts in the ten minutes, he makes 20 cents.

Executives of Reed-Prentice admit that "if" plays a big role, but declared that they had yet to find many workers who were unable to do a good job. Incidentally, the worker gets all the savings and does not split with employers.

Dream On . . . In case you get down to the plant feeling irritated at having been rudely awakened by a raucous old-fashioned alarm clock, you will be delighted with the clockmakers' new ads. They assure us that we will be brought from between the sheets by a tuning in of our favorite radio program, by the playing of musical selections and possibly many other easy methods of snore-stopping.

This is certainly intriguing but we know a few guys who wouldn't be very good prospects. Nothing short of a crack over the head gets them out of bed and the playing of a musical selection would cause them to do no more than sigh, turn over and perhaps hum softly to themselves in their sleep. In fact, ye *Chips* editor sees one such person in the mirror every morning.

The Reader Speaks . . . Stuart Keneiff of Mt. Carmel, Ill., has written us several notes on a subject dear to his and our hearts: Disposal of government surplus tools, particularly light machine tools. His first point is that smaller shops in small towns or other locations remote from surplus tools are handicapped in their efforts to buy; his second is that schools and colleges need more modern equipment. His suggestion is that they be advertised where operators of such shops will see the ads, and that ads include detailed description and price.

Any second to this motion . . . or any rebuttal?

More Hargest . . . Continuing a few comments from Editor Bill Hargest—your "Eyes in Metalworking Europe":

"Near Berlin we stopped at a Russian outpost, dug out a tin of Nescafe from a duffel bag and treated the Russians to a couple of cups of real coffee. They offered me 1,000 *marks for the coffee—the equivalent of* $100. *What do you think I did?*

"Frankly, I had a devil of a time getting away from the post. The Russians wanted to buy my wrist watch, my fountain pens, a four-color lead pencil, a Dunhill lighter, my trench coat, and even my pants. Had I been willing to part with all these I figured to have made about $800.

"Not knowing whether or not it would be permissible to change Russian marks into English or American money, I kept my goods. However, methinks I will do that trip over again and go 'loaded for b'ar.'"

(Ed. Note: One of the young ladies here in the office had sent Bill a package of Nescafe and we wouldn't be at all surprised if that is what the ingrate sold. She wants a cut on the profits.)

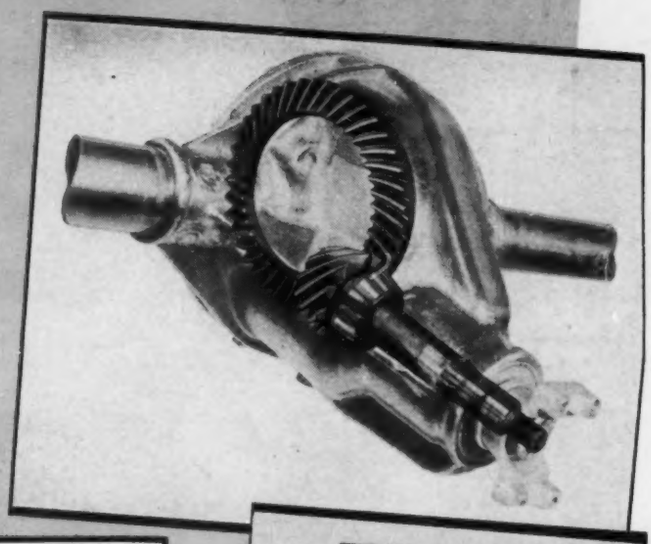
Pass the Palette . . . Our cover picture is from the El Segundo machine shop of Standard Oil of California. It shows the application of "color dynamics" to reduce glare, eyestrain and to make working conditions more pleasant. Overhead elements are in soft blue, walls turquoise or creamy yellow with gray dado.

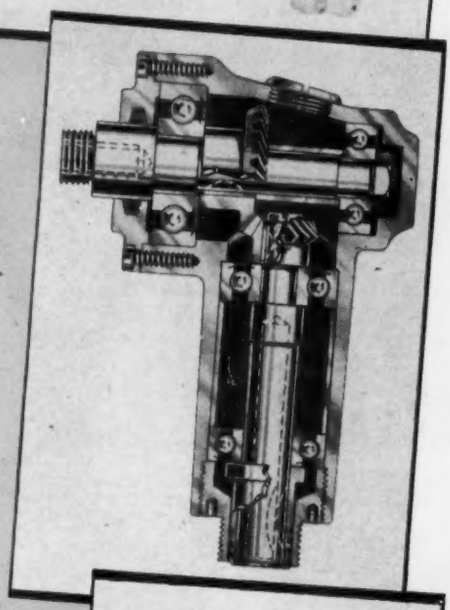
Stationary machine parts are a soft dark green, so they recede and blend. Moving or critical parts are light cream to focus the operator's attention, contrast with work and improve light reflection. Operating handles are bright orange for attention. This attractive Kodachrome picture came to us by courtesy of Pittsburgh Plate Glass Co.

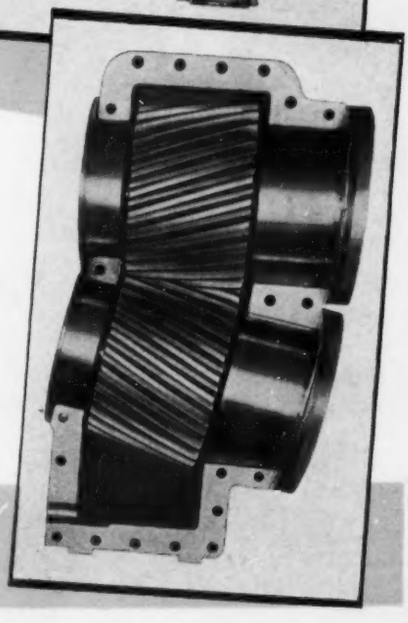
All these fancy fixings may be a shock to some old-time shop men, but we can assure you that such color schemes have been scientifically thought out and really help in plant operation.

ARE YOUR POWER TRANSMISSION PROBLEMS

LOAD?
SPEED?
ANGLE?







Bevel gears to transmit power and motion can be produced to satisfy any angular drive requirement with no limitations as to load, speed or shaft angle.

LOAD

Bevel gears can be designed to provide unfailing operation for all load requirements. One of many examples of the high load capacity of bevels is the hypoid automotive rear-axle drive gears at upper right.

SPEED

Smooth and quiet power transmission at any speed is easily obtained by use of the right type of bevel gear. Successful hi-speed performance is illustrated by the portable tool head at right which operates at 17,000 R.P.M.

ANGLE

Wherever power turns a corner a pair of bevels may be made for the job. The 10° shaft angle V-drive (lower right) used in marine propulsion is just another example of the versatility of bevel gears.

Let us assist you with your bevel gear design problems. Send us blueprints of your proposed bevel gear designs, and our engineers will study them, suggest improvements and recommend the correct gear cutting equipment.

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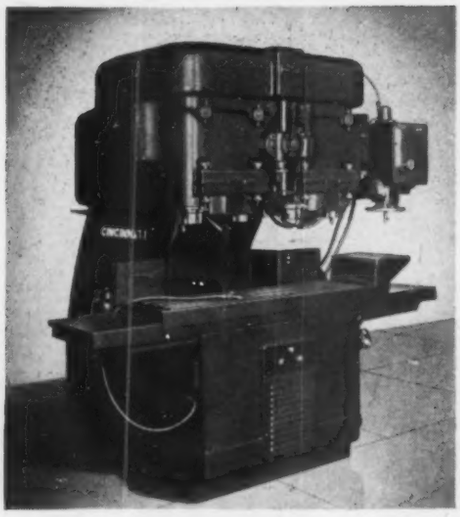


CINCINNATI Four-Spindle 360 Degree Automatic Profiler. Catalog M-1215.

CINCINNATI 16" Series Vertical Hydro-Tel Milling Machine. Specification sheet M-1388.

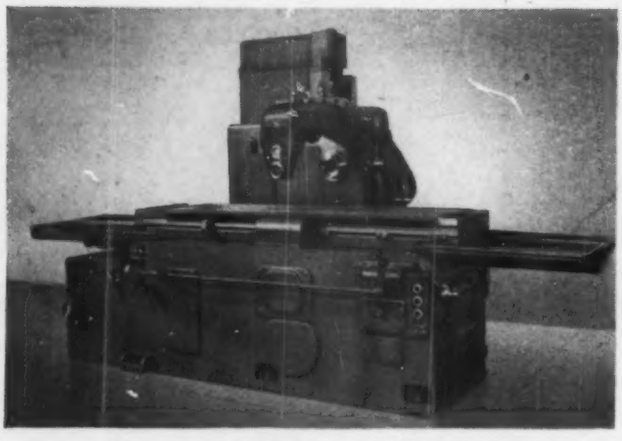
CINCINNATI Dial Type Milling Machine. Catalog M-970-3.

CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine. Catalog M-964-3.

CINCINNATI No. 0-8 Vertical Milling Machine. Catalog M-893-2.

FOR YOUR MILLING BROACHING AND CUTTER SHARPENING OPERATIONS

CINCINNATI



CINCINNATI Tracer Controlled Hydromatic Milling Machine.

CINCINNATI No. 1-18 Plain Automatic Milling Machine. Catalog M-848.

For a brief description of these machines, look in Sweet's Catalog File for Mechanical Industries.

THE CINCINNATI MI

MILLING MACHINES

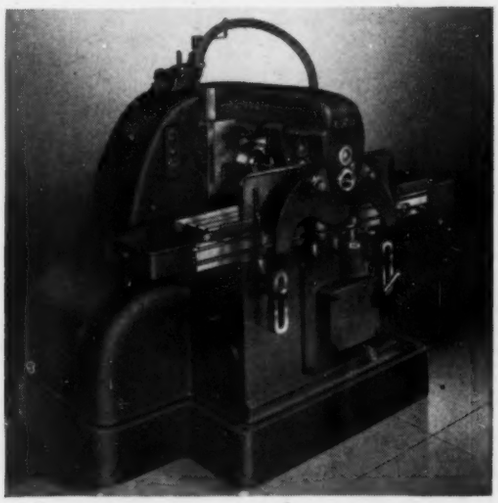
CINCINNATI No. 2 Cutter and Tool Grinder. Catalog M-962-3.

CINCINNATI Monoset Cutter and Tool Sharpener. Catalog M-1386.

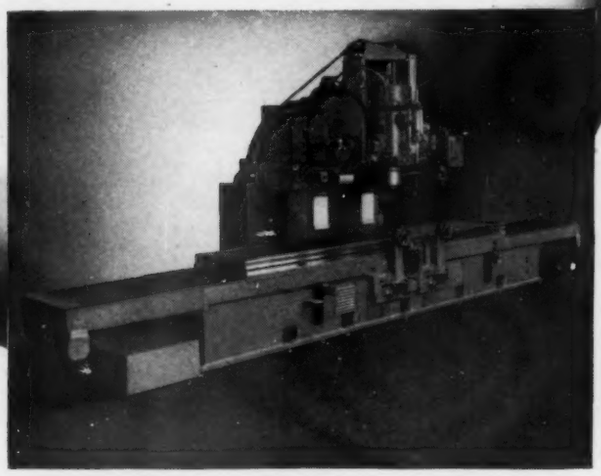
CINCINNATI Duplex (double ram) Vertical Hydro-Broach. Catalog M-1387.

The machines illustrated on these pages will give you an idea of the comprehensiveness of the Cincinnati line. A complete showing of all Milling, Broaching and Cutter Sharpening Machines manufactured by this company will be found in our recently published general Catalog No. M-1420. A copy will be sent on request. For full information and specifications on any of the machines illustrated, write for individual catalogs. Be sure to ask for them by the numbers shown beneath the illustrations of machines in which you are interested.

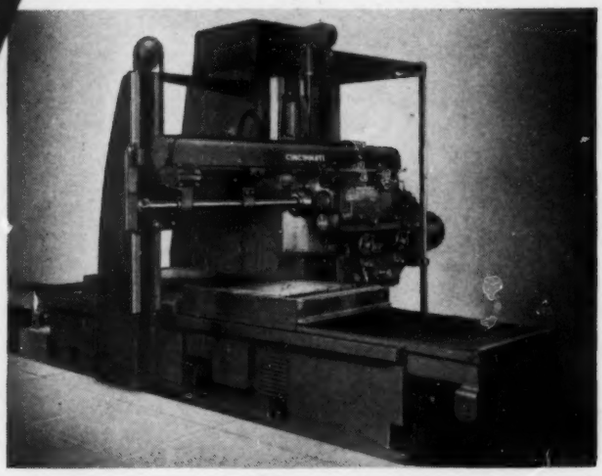
Turn to pages 12 and 13 of this issue of American Machinist for Cincinnati Cylindrical Grinding and Lapping Machines.



CINCINNATI No. 2-24 Plain Automatic Milling Machine. Catalog M-965-2.



CINCINNATI 28″ Series Vertical Hydro-Tel Milling Machine. Catalog M-1284.



CINCINNATI 36″ Series Horizontal Hydro-Tel Milling Machine. Catalog M-1285.

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

Planning something . . . ?

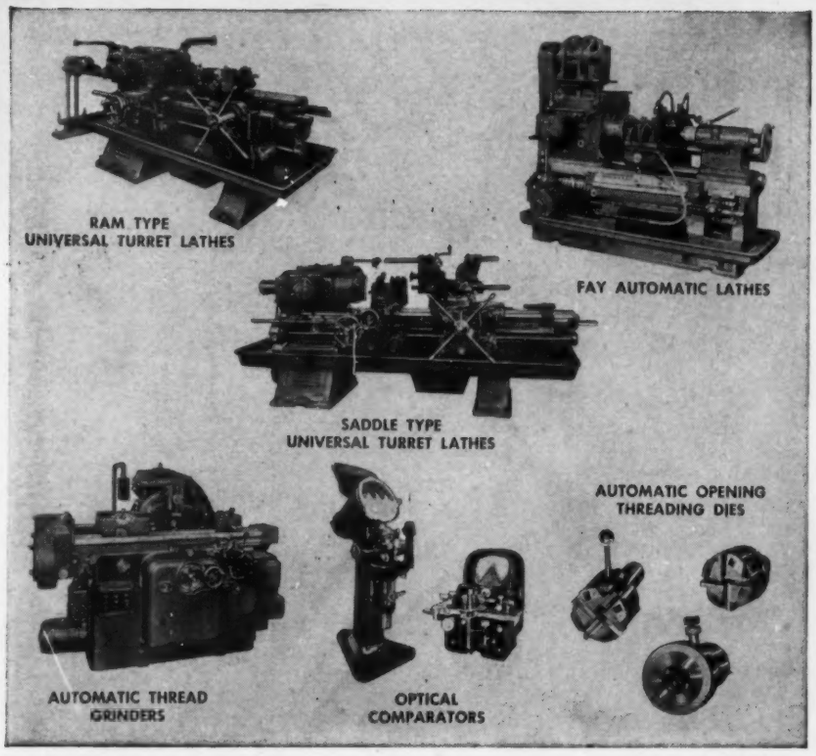
We can help you make it Better for Less

Competition will be intense in the days to come. Profits will depend upon Low Cost Production with the most efficient machines and methods.

Now is the time to scrap your old equipment and replace it with either War Surplus Machines or new machines that can transmit the power and that have the rigidity to use carbide cutting tools at their maximum efficiency.

For these cutting tools provide the fastest known method of metal turning today, increasing cutting speeds from 200 to 500 per cent.

Jones & Lamson Turret Lathes and Fay Automatic Lathes are designed specifically for the most efficient use of carbide tools. Send for our book, "Welcome to You and Your Problem." Or, better yet, 'phone now for one of our engineers . . . to help you make it better for less.



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STEP-UP GEAR TRAIN

The 7-Type Fellows Gear Shaper on which the gear train is machined.

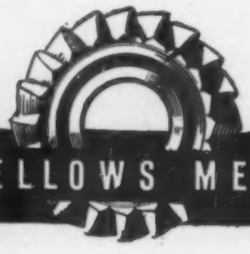
...N SPECIFICATIONS
to ±.00025 and ±.0005

1 INTERNAL GEAR:
Number of Teeth (Involute) 153
Diametral Pitch 60
Pitch Diameter . . . . . 2.550 (+.00025)

2 PINION:
Number of Teeth (Involute) 21
Diametral Pitch 60
Pitch Diameter . . . . . .350 (±.00025)

3 PLANET GEAR:
Number of Teeth 105
Diametral Pitch 60
Pitch Diameter . . . . . 1.750 (±.0005)

4 DRUM PINION:
Number of Teeth 27
Diametral Pitch 60
Pitch Diameter . . . . . .450 (+.00025)



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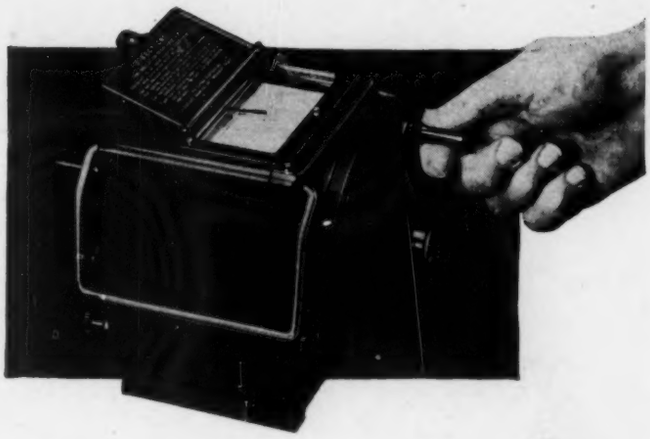
Of utmost importance in the operation of this ultra-sensitive instrument is the hand-cranked gear train which drives its generator. In fact, it is so highly essential that each fine-pitch gear and pinion be of the nth degree in accuracy for *smooth* performance, that Biddle engineers are satisfied only when each unit is machined with original Fellows Cutters on the Fellows 7-Type Gear Shaper.

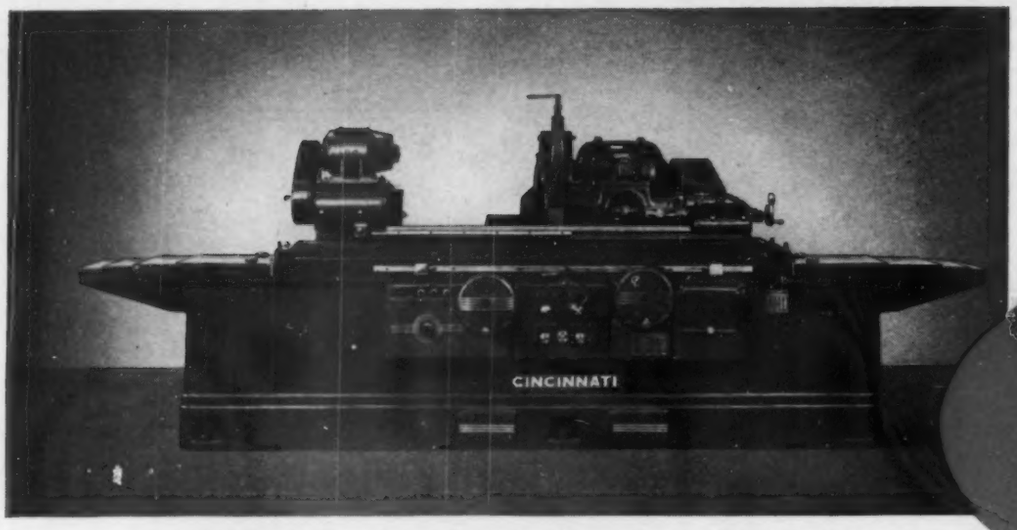
This accounts in part, too, for the "Megger" Instrument's complete independence of any parts requiring replacement or adjustment—and for its steady assurance of trouble-free, dependable service.



Fellows sales engineers welcome the opportunity to consult with your engineers and designers on gear problems, routine or unusual. Write: The Fellows Gear Shaper Company, Springfield, Vermont, or 616 Fisher Bldg., Detroit, or 640 West Town Office Bldg., Chicago.

Fellows

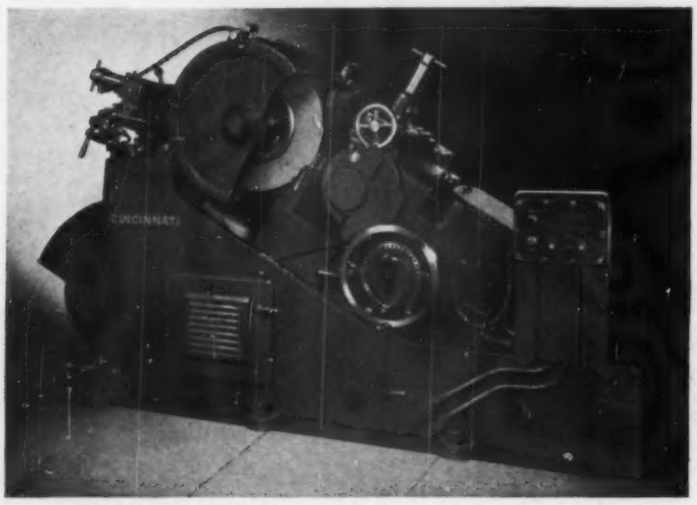
ALL OPERATIONS FROM BLANK TO FINISHED GEAR



For your

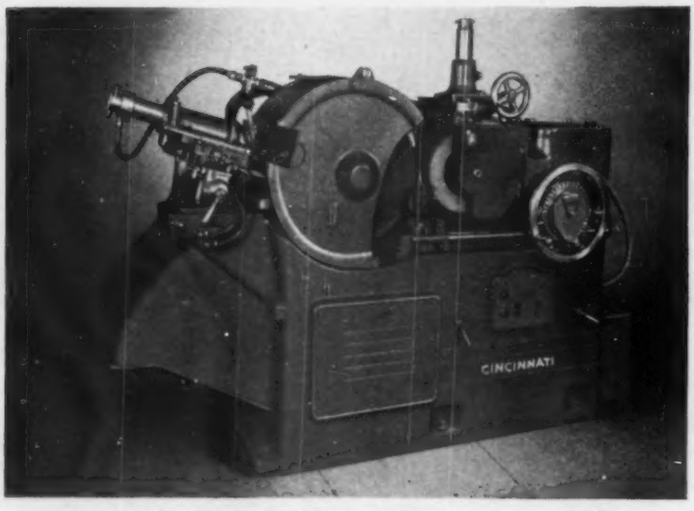
CINCINNATI

CINCINNATI 10″ Plain Hydraulic Grinding Machine. Also available in 14″ L size. Between-center lengths, 18″, 36″, 48″, 72″ and 96″. Catalogs G-490-1 and G-533.

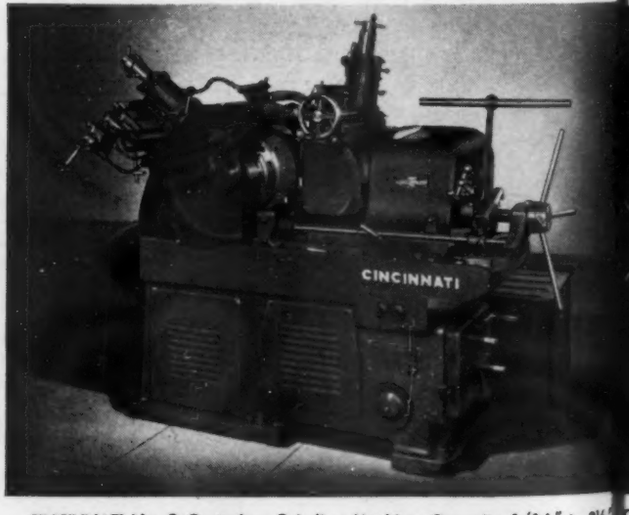


CINCINNATI No. 4 Centerless Grinding Machine. Capacity up to 9″ diameter. Specification sheet G-3506.

CINCINNATI 6″ Plain Hydraulic Grinding Machine. Also available in 10″ size and between-center lengths 18″ and 30″. Catalog G-537.



CINCINNATI No. 3 Centerless Grinding Machine. Capacity up to 6″ diameter. Catalog G-438-3.



CINCINNATI No. 2 Centerless Grinding Machine. Capacity 1/16″ to 3½″ diameter. Catalog G-456-3.

For a brief description of all Cincinnati Grinding and Lapping Machines, look in Sweet's Catalog File for Mechanical Industries.

CINCINNATI

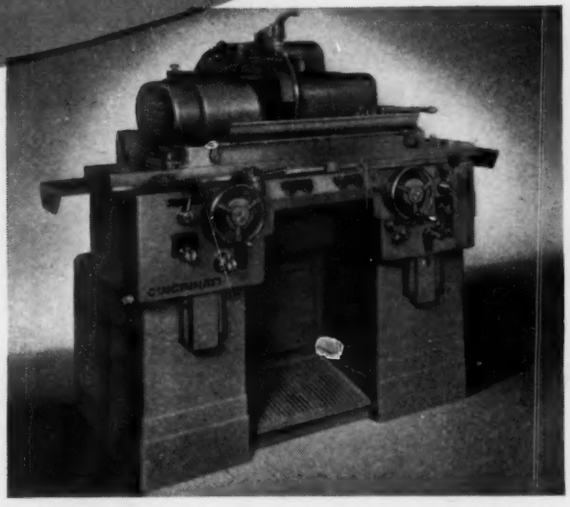
CENTER TYPE GRINDING MACHINES

PRECISION CYLINDRICAL GRINDING OPERATIONS

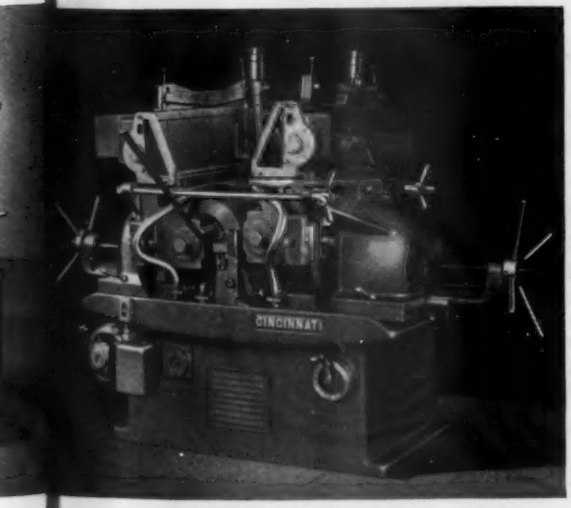
CINCINNATI'S Line of Centertype and Centerless Grinding Machines and Centerless Lapping Machine are shown on these two pages. A brief description, together with other important data on these machines, is contained in our recently published general Catalog No. M-1420. A copy will be sent on request. For more detailed information and complete specifications on any of these machines in which you are interested, we suggest you send for individual catalogs. When writing, please ask for catalogs by the numbers shown beneath the illustrations.

Turn to pages 4 and 5 of this issue of American Machinist for information on Milling, Broaching and Cutter Sharpening Machines.

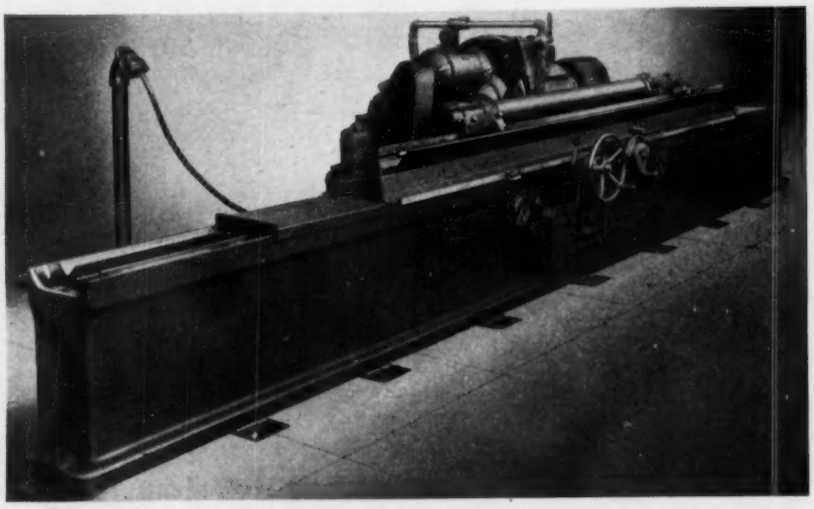
CINCINNATI 12″ Hydraulic Universal Grinding Machine. Also available in 14″, 16″ and 18″ sizes, and between-center lengths 36″, 48″ and 72″. Catalogs G-486-3 and G-474-3.



CINCINNATI 4″ Plain Hydraulic Grinding Machine. Built in 12″ and 18″ lengths. Catalog G-520.



CINCINNATI Centerless Lapping Machine. Capacity ¼″ to 3″ diameter, tolerances within .000005″.



CINCINNATI 14″ Plain Self-Contained Grinding Machine. Also available in 16″ size and between-center lengths from 36″ to 168″. Catalog G-491-2.

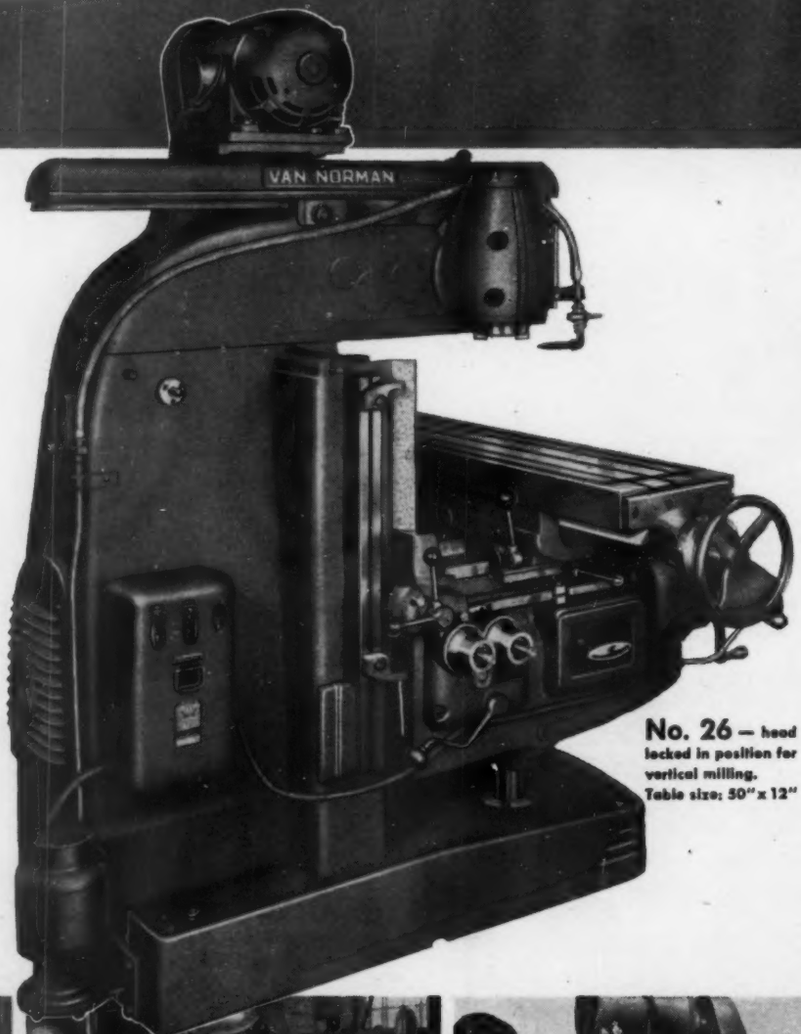
GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

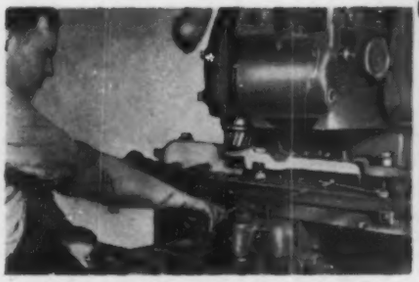
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

VAN NORMAN RAM-TYPE MILLERS

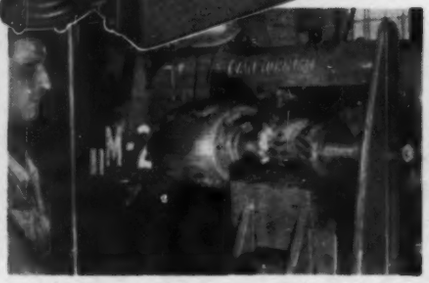
Simplify



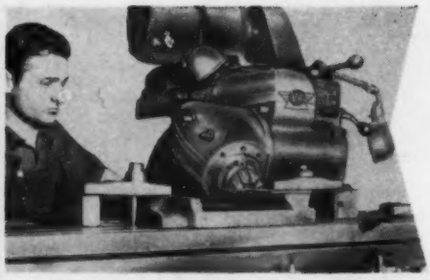
No. 26 — head locked in position for vertical milling. Table size: 50" x 12"



The Ram-Type Miller used with the adjustable cutterhead in the vertical milling position and the operator using the front directional controls.



The Van Norman Ram-Type Miller with the head locked in the horizontal position for a gang milling operation. Operator is using rear controls.



With the cutterhead locked in an angular position, the operator is taking an angular cut on the workpiece, operating the miller with the rear directional controls.

Milling Operations

- ★ **Horizontal Angular, Vertical Milling . . . all with One Machine.**
- ★ **Adjustable Cutterhead Minimizes Idle Machine Time.**
- ★ **Front and Rear Controls Increase Operator Output, Reduces Worker Fatigue.**
- ★ **Moveable Ram Enables Operators to Handle More and Bigger Work Pieces.**

In the toolroom, machine shop, pattern shop, experimental laboratory or production department, the Van Norman Ram Type Miller, with its adjustable cutterhead, meets daily fluctuating requirements by enabling operators to perform horizontal, angular or vertical milling on *one* machine with conventional milling practice and standard arbors and cutters . . . *without* special attachments. The result: idle machine and operator time is cut by as much as 50% . . . errors minimized . . . production increased.

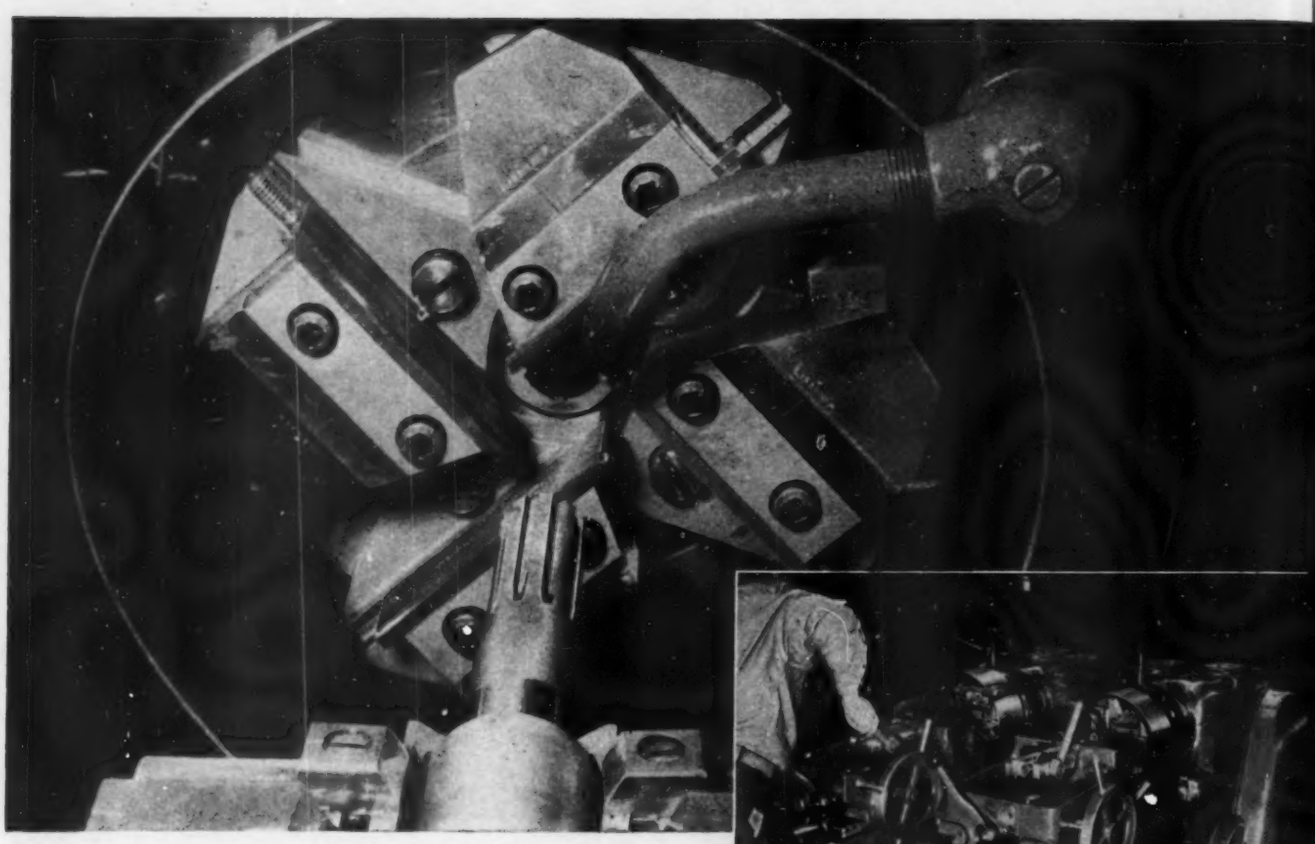
Front and rear directional power and hand controls provide complete visibility of the milling operation . . . eliminate back and forth operator motion . . . reduce worker fatigue . . . provide increased operator safety. Other features include single lever feed selector, moveable ram, automatic lubrication. Investigate the Van Norman Ram Type Millers today. See how they cut costs, improve accuracy and increase production. They are available in fourteen models . . . a size to meet every requirement.

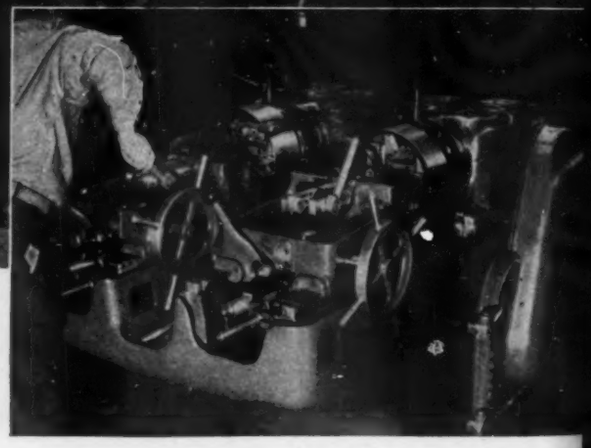
VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"

Threading Automotive Parts...The Landis Way





Write for Bulletin H-75

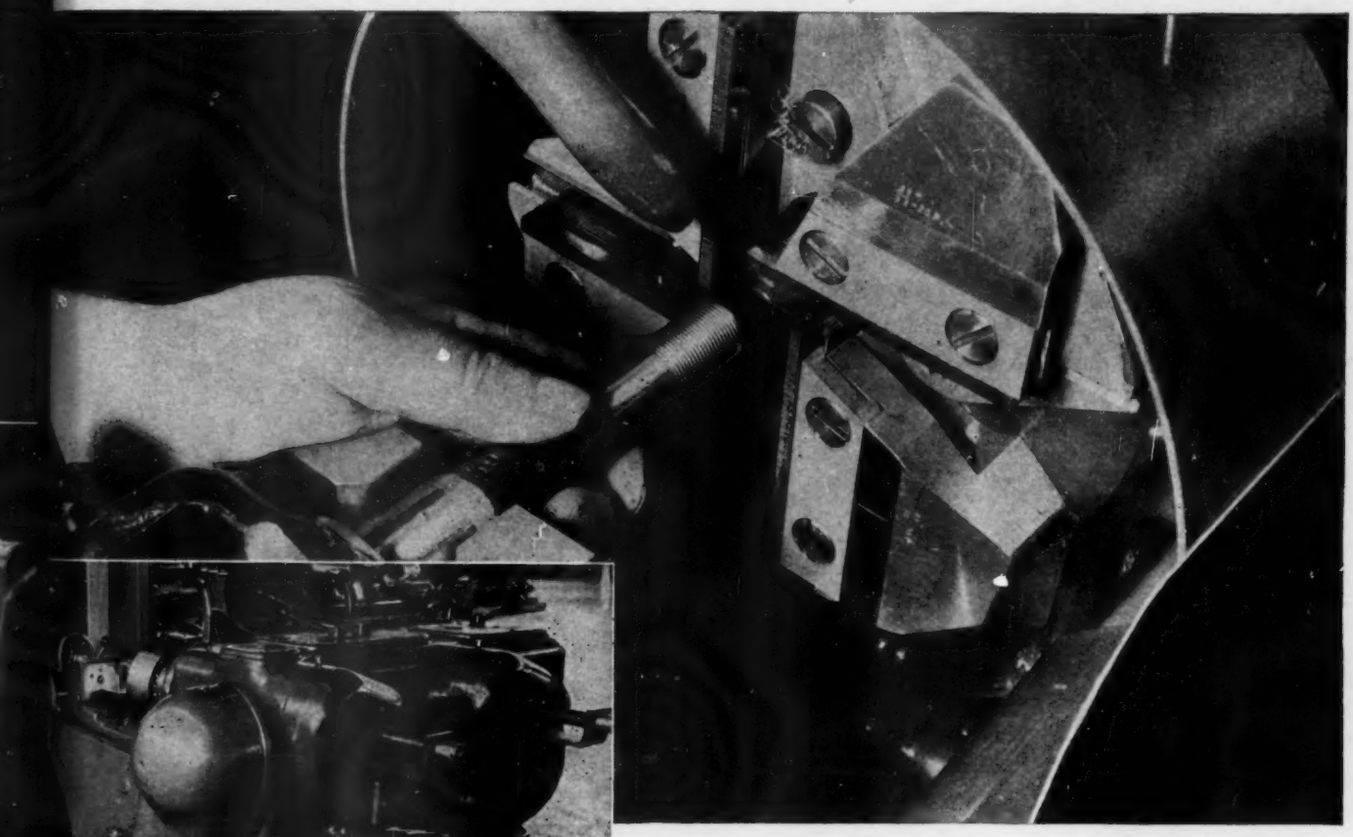
The Landmaco Threading Machine thre
ing spiral hypoid drive pinions. Th
pinions must be precisely made for perf
assembly, as, once assembled, they
never expected to require attention.

LANDIS

THREADING MACHINERY · THREAD CUTTING DIE HEADS

LANDIS THREADING MACHINES are used extensively in automotive plants. Accuracy is of prime importance. Threads must meet the most rigid requirements and must conform exactly to specifications. Besides accuracy, other features are—economy, ease of operation and high productivity with resultant low cost.

The widespread use of Landis Threading Equipment throughout the automotive industry—where threads must be held to closest tolerances—is just another proof that thread production throughout all metal industries can be safely and economically handled by Landis Threading Machines and Die Heads.



The Landmaco Threading Machine threading truck steering knuckles. Threads must be exactly right to assure the permanent holding of a vital part in a truck steering mechanism.

LANDIS TRADE-MARK REG. U.S. PAT. OFF.

MACHINE CO. WAYNESBORO PENNA. U.S.A.

COLLAPSIBLE TAPS · PIPE THREADING AND CUTTING MACHINES

Performance for PROFIT...

"American" Lathes from the largest to the smallest are ready and "all set" to meet every challenge of peacetime production. The power, stamina and endurance built into "American" Lathes are proving invaluable to many a plant in this highly competitive era.

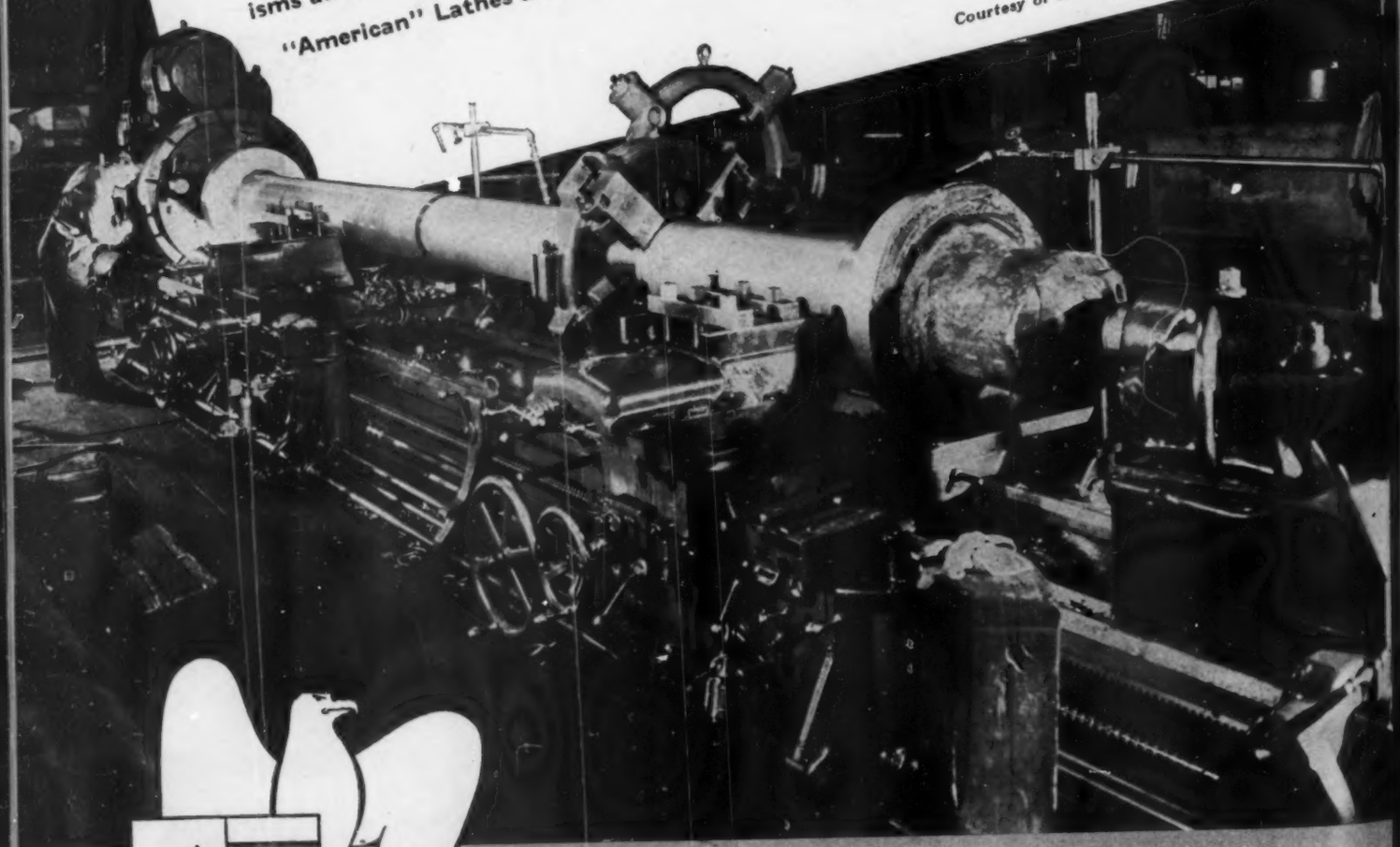
Dependable service, minimum shut-down for failure and repairs, coupled with an almost unbelievable ability to "keep going" under any and all conditions, are genuine "American" characteristics.

"American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

"American" Lathes are an asset in any plant.

Send for Bulletin No. 87

Courtesy of Allis-Chalmers Manufacturing Co.



THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

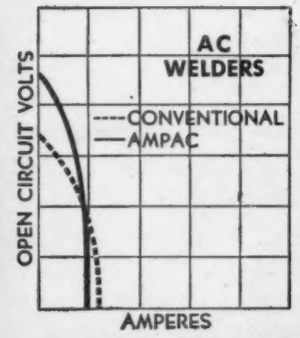
Lathes and Radial Drills

AMPAC'S PATENTED CIRCUIT GIVES YOU

Magic Arc Control

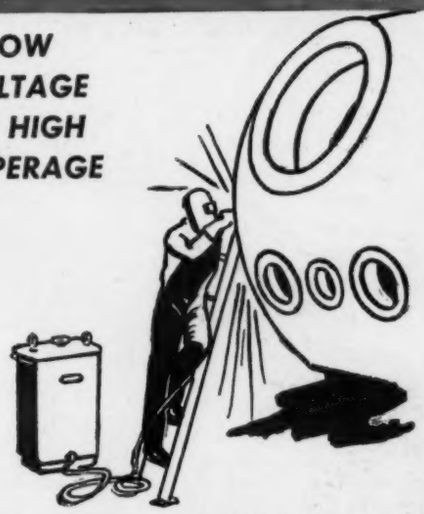
with Correct Striking Voltage Every Time!

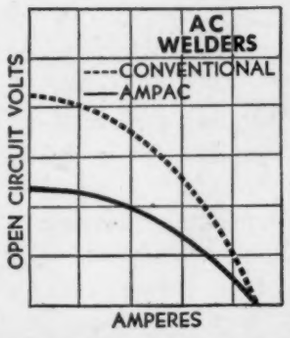
HIGH VOLTAGE AT LOW AMPERAGE



All Welders know that low amperage settings require *higher* arc striking voltage. But Ampac welder's patented circuit steps up this voltage automatically. Conventional transformer type welders have *same* open circuit voltage for both high and low settings.

LOW VOLTAGE AT HIGH AMPERAGE





On high amperage settings Ampac *automatically* cuts down excess arc striking voltage. You get better power factor, lower power costs. And there's no dual control—no changing of taps! Ampac's *magic arc control* gives you *correct* striking voltage every time.

Secret of magic arc control lies in Ampac's patented circuit that automatically provides correct striking voltage for every amperage setting. It's typical of the fine engineering in all Allis-Chalmers welders.
A1937

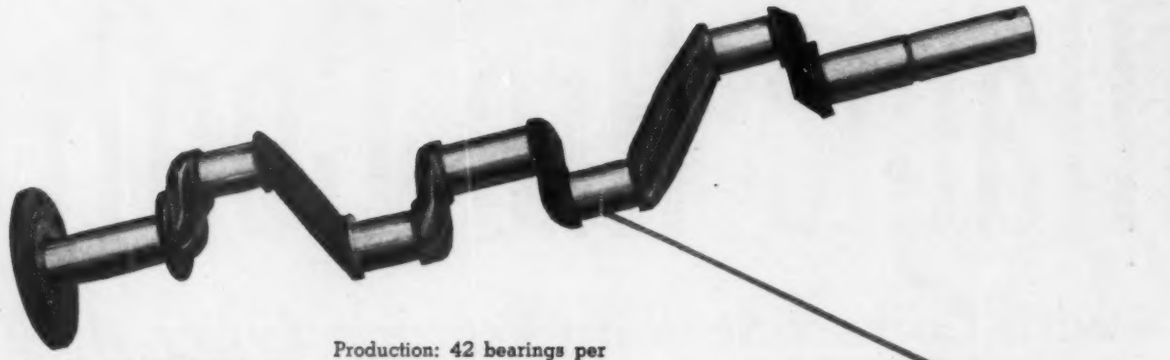
GET THE COMPLETE AMPAC STORY

Contact our nearby welder dealer or district office for full details on efficient, economical Ampac welders with magic arc control. Also inquire about A-C's complete line of electrodes and welding accessories. ALLIS-CHALMERS, MILWAUKEE 1.

ALLIS CHALMERS

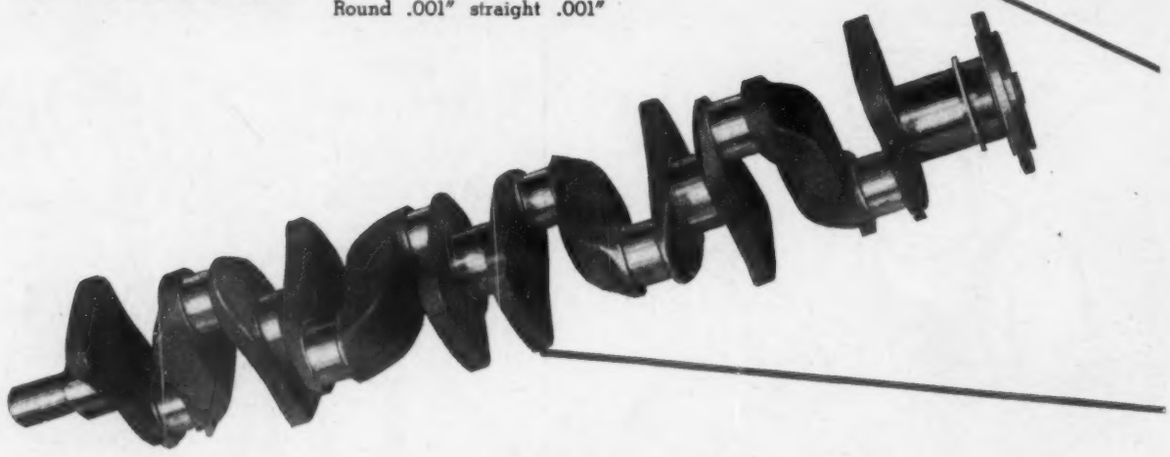
HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

DETROIT PUBLIC LIBRARY



1910 CRANKSHAFT

Production: 42 bearings per 8 hr. day. Tolerance for size: Round .001″ straight .001″



TODAY'S CRANKSHAFT

Production: 320 bearings per 8 hr. day. Tolerance for size: Round. 0005″ Straight. 0003″

The 100,000 mile automobile engine has become possible because of low cost mass production to progressively closer tolerances.

The increased production and closer tolerances of today's LANDIS TOOL grinding machines — typified by the crankshaft job shown above—are due to design developments pioneered by Landis Tool engineers.

The increase of almost 800% in bearing output comes from a combination of high production features first introduced on LANDIS TOOL grinding machines.

These include a single loading setup for grinding all pins: hydraulic controls for feed, traverse and work clamping; hydraulic rapid infeed; multi-function control lever. Tolerances were cut in half and accuracy doubled again as a result of LANDIS TOOL features that made possible high precision and fine finish. These include The Microsphere Wheel Spindle bearings for closer bearing clearance; dynamically balanced rotating parts to eliminate vibration; multiple V belt drive for smooth driving power; massive wheel base and machine bed for greater rigidity; casts parts annealed for stress removal.

If you have a grinding problem that involves cost reduction or precision finish, investigate the features of LANDIS TOOL—call on our engineers for help in solving your grinding problem.

No. 44

LANDIS TOOL

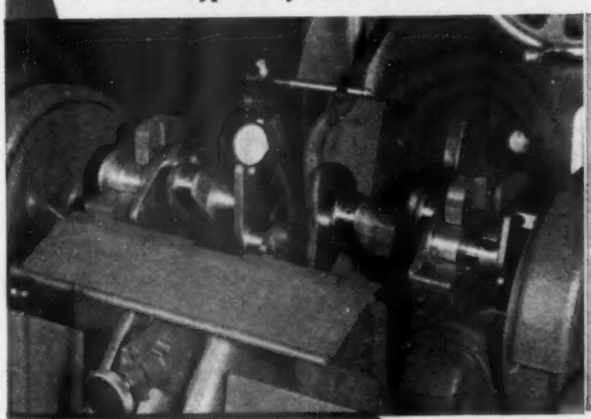
Precision Grinders

How Design Features of Landis Tool Grinders

Reduce Costs and give *Closer Tolerances*

Automotive Crankshaft grinding experience is typical

16″ x 42″ Type D Hydraulic Crank Grinder



Crank in Grinding Position with Visual Sizing gauge and crank carrying fixtures

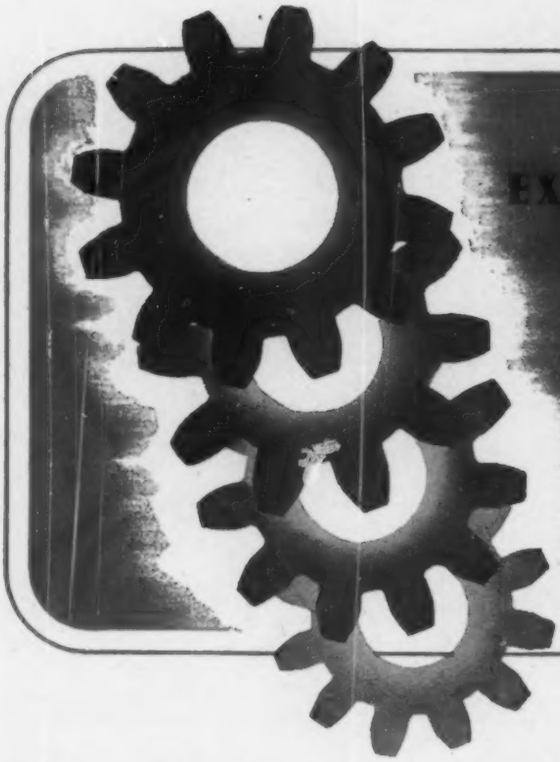
HIGH PRODUCTION FEATURES

Hydraulic Rapid Infeed
Multi-function Control Lever
Hydraulic feed, traverse, workclamp.
Single setup for grinding all pins

PRECISION FINISH FEATURES

Microsphere Wheel Spindle Bearings
Dynamically Balanced Rotating Parts
Massive Wheelbase
Multiple V Belt Drive

LANDIS TOOL CO., WAYNESBORO, PA.



EXCELLENT CHARACTERISTICS OF SHAVED GEARS

Can be Preserved in Hardening

Gear tooth hardness need no longer be a compromise between machinability and wear resistance. Red Ring Rotary Gear Shaving as the final machining operation on the green gear, during which approximately .001″ of stock is removed from the tooth surfaces, corrects cutting errors of index, helical angle, tooth profile, eccentricity and undesirable tooth roughness.

This corrected gear may then be induction hardened to whatever surface hardness is desired and without objectionable distortion. Hardening without detrimental distortion is frequently accomplished on gears carburized after shaving by quenching in dies and sometimes by liquid carburizing and quenching without dies. No grinding of tooth profile is necessary.

On a 5.145″ P.D. gear so treated, final involute error is held to between +.00015″ and —.00015″; parallelism to .0002″; tooth spacing to .0001″ to .0002″; and accumulated error to .0008″.

WRITE FOR DESCRIPTIVE FOLDER ON RED RING GEAR SHAVING

Specialists on SPUR AND HELICAL INVOLUTE GEAR PRACTICE

Originators of ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

5000 ST. JEAN • DETROIT 13, MICH.

It is reported that . . . . . .

A technical magazine states that the war-developed arc-oxygen electrode will cut quarter-inch steel plate at the rate of a foot per second while under 40 feet of water. *Metal and Thermit Corp.*

get ready with CONE for tomorrow

It is estimated that within a few years 80% of the coal mined underground will be removed from the mines on conveyor belts instead of in cars. *Scientific American.*

get ready with CONE for tomorrow

The PV-3 helicopter has a long fuselage with a rotor on each end and carries twelve persons. It is being tested by the Coast Guard and Navy. *Popular Science.*

get ready with CONE for tomorrow

A new cement, for use in concrete flooring, is said to drive away insects, kill bacteria, and prevent the formation of molds. It also dissipates static electricity. *H. H. Robertson Co., Pittsburgh.*

get ready with CONE for tomorrow

An appliance manufacturer announces an electric washing machine that can also, by the use of attachments, wash dishes, peel potatoes, churn butter, and freeze ice cream. *Hurley Machine Division Elec. Household Utilities.*

get ready with CONE for tomorrow

A new gasoline-powered lawn mower resembles a floor scrubbing machine. It is mounted on four wheels and uses a rotary knife revolving at 3,000 r.p.m. *Whirlwind Lawn Mower Corp., Milwaukee.*

get ready with CONE for tomorrow

The manufacturer of the jet engine used in the P-80 Shooting Star prophesies that all transcontinental planes will be jet-propelled within five years. *General Electric.*

One of the war devices that may survive to help the motorist is the tire gauge that registers on the dash, developed for the Army's amphibious "duck." *GMC Truck and Coach Div.*

get ready with CONE for tomorrow

A magnetic survey of the state of Florida shows large areas in the southern part that are favorable for the occurrence of petroleum. *U. S. Dept. of Mines.*

get ready with CONE for tomorrow

Meals are being served in the Naval Air Transport Service that are pre-cooked, packed in a covered paper plate and frozen. On the plane they are thawed and heated in a special oven. *Maxon Sky Plate, W. L. Maxon Corp., 460 W. 34th St., New York.*

Air conditioned trolley cars are being introduced in a Southern city. This is said to be the first use of such equipment in city vehicle transportation. *Atlanta, Ga.-Pullman-Standard.*

get ready with CONE for tomorrow

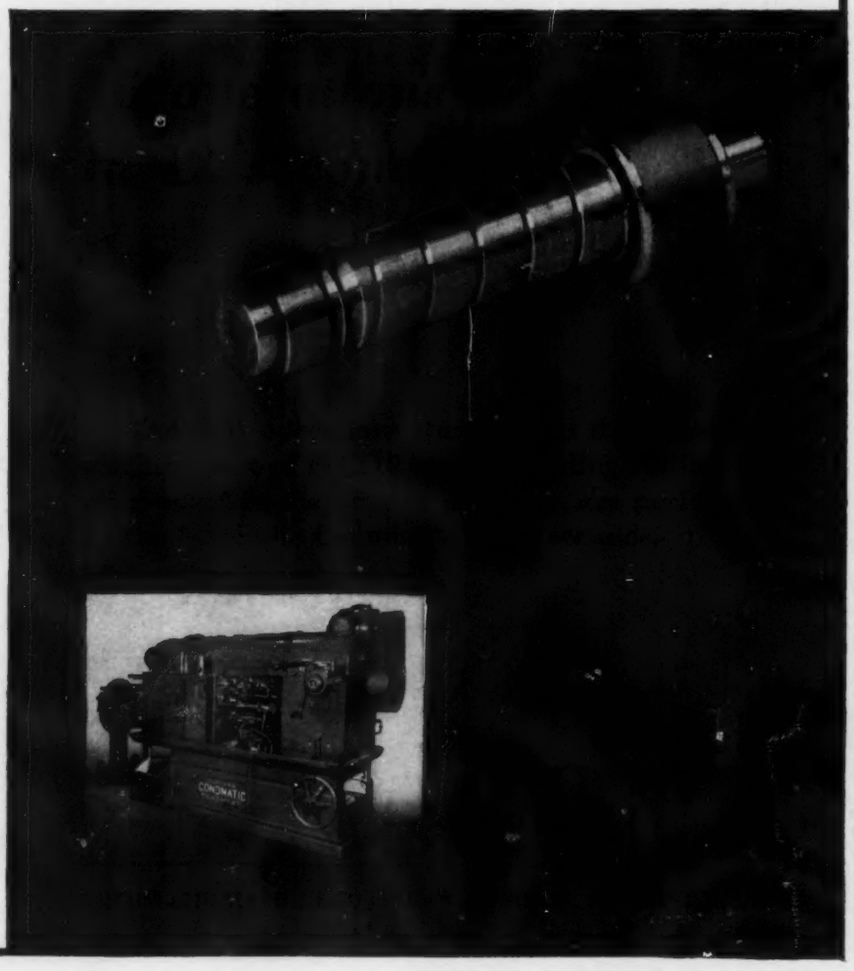
A new household electric light switch can be set for delayed action up to three minutes. *T. J. Mudon Co., 1240 Merchandise Mart, Chicago.*

get ready with CONE for tomorrow

Rubber V-belts molded around a steel cable have been developed to replace chain drive on Army motorcycles. *Goodyear, Akron 16, Ohio, Whizzer Motor Co., Los Angeles.*

get ready with CONE for tomorrow

Even the common wire nail has been improved. The new type has a notch in place of the point and is claimed to be non-splitting. *E. S. Gair, Snyder, New York, inventor.*



Are You Cutting Metals and Non-metals the Modern Way . . .

NORTON ABRASIVES

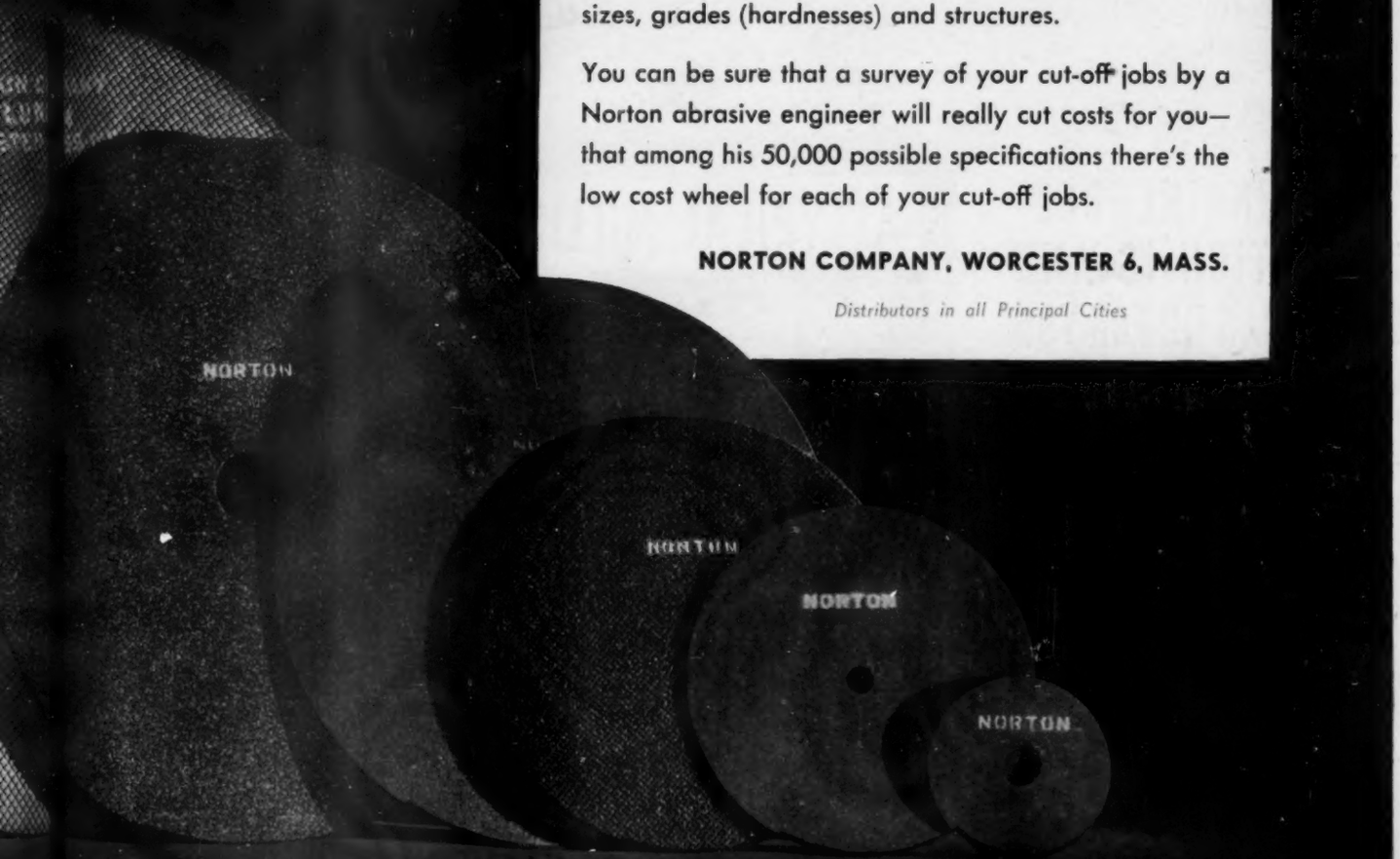
. . . with NORTON Cut-off WHEELS?

WHEN a Norton abrasive engineer tackles your cut-off jobs he's not limited to one special type of wheel. He has a complete line to choose from—over 50,000 possible specifications. For example, he has several varieties of resinoid bond, both natural and synthetic rubber bond, and shellac bond. He has Alundum, 57 Alundum and Crystolon abrasives. And in each abrasive and bond he has a wide range of grit sizes, grades (hardnesses) and structures.

You can be sure that a survey of your cut-off jobs by a Norton abrasive engineer will really cut costs for you—that among his 50,000 possible specifications there's the low cost wheel for each of your cut-off jobs.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in all Principal Cities



W-1040

SUNDSTRAND

YOUR GUIDE TO BETTER, "ENGINEERED" PRODUCTION MORE PROFITABLE MILLING

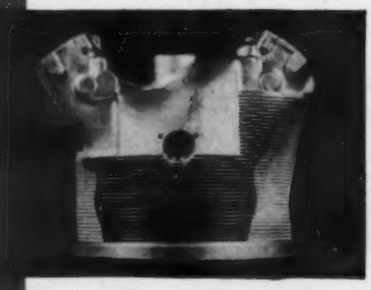
Production milling problems vary from one plant to another and from one industry to another. Consequently, *each* problem must be analyzed thoroughly in order to obtain the most economical solution. Production, as well as equipment, *must be "engineered"*.

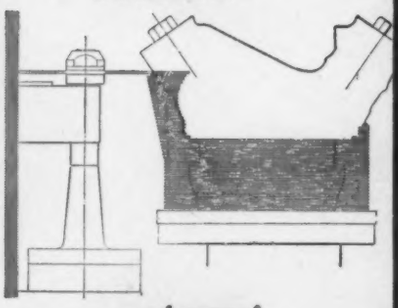
WHAT "ENGINEERED" PRODUCTION IS AND WHAT IT CAN DO FOR YOU

Sundstrand "engineered" production is a service provided by a staff of competent engineers who have had wide experience with metal working problems in all types of industries.

This experience has been responsible for effecting greater production, better accuracy and finer finish in countless installations. A Sundstrand production engineer will be glad to help you on production milling problems. There is no obligation for this service.

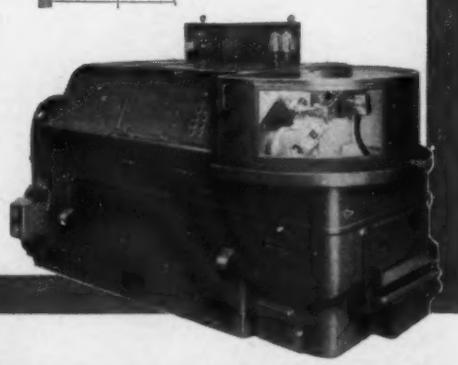
A TYPICAL MILLING PROBLEM SOLUTION





MILLING FINS IN AIRPLANE CYLINDER HEAD FORGING

One of the outstanding features of this special machine is the arrangement for controlling the contour of the cut and the cutter load. Hydraulic feed against a positive cam controls the contour. An automatic electronic feed control keeps the cutter loaded to full capacity. Where the cut becomes light, the rate of feed increases—when heavy, the feed rate automatically decreases.



FREE

MORE PROOF

of the successful application of Sundstrand "engineered" milling production is contained in this new book. Over 60 problem solutions complete with tooling diagrams are included. Write for your copy today. Ask for bulletin No. 142.

SUNDSTRAND MACHINE TOOL COMPANY

2533 Eleventh St. • Rockford, Ill., U. S. A.

RIGIDMILLS • AUTOMATIC LATHES • SPECIAL MILLING AND TURNING MACHINES

JET PROPULSION

Smoothness by Gisholt

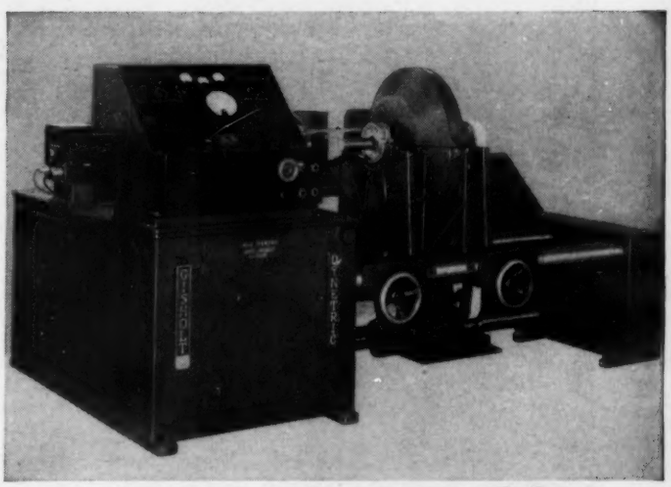
Heart of one jet propulsion engine is the 300 lb. impeller (air compression member) here shown mounted in a Gisholt Dynetric Balancer. The impeller must be freed from any trace of unbalance—for at jet engine speeds, the slightest vibration is disastrous!

GISHOLT DYNETRIC BALANCING MACHINES* do the job so well that these ultra-high speed rotors spin with an off-center displacement of *less than one ten-thousandth of an inch!*

Again Gisholt engineers fulfill their pledge to "balance anything that rotates" . . . from ½ ounce to 50 tons. *Freedom from unbalance vibration* means greater safety, less wear, better service—distinctly longer life!

Fast as it is accurate, Gisholt Dynetric Balancing actually cuts balancing costs. But get all the facts . . . write for full details!

**A development of Westinghouse Research Laboratories.*



GISHOLT DYNETRIC BALANCING MACHINES measure unbalance vibrations as small as .000025" at the bearings of the work piece. By simple dial readings, the amount and angular location of required corrections are determined in a matter of seconds.

GISHOLT MACHINE COMPANY
1201 East Washington Avenue • Madison 3, Wisconsin

GISHOLT

Look Ahead . . . Keep Ahead . . . With Gisholt

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

Proven quality and dependability of performance are hallmarks of the products of the Mid-West Abrasive Company.

Mid-West's outstanding successful tool room grinding wheel, and every other product of the broad Mid-West line—honing stones, sharpening stones, coated abrasives, disks and wheel dressers—all must bear these two hallmarks.

Let engineered quality and dependability guide you in your choice of abrasives, and we feel certain that choice will be Mid-West. Prompt delivery on all items.

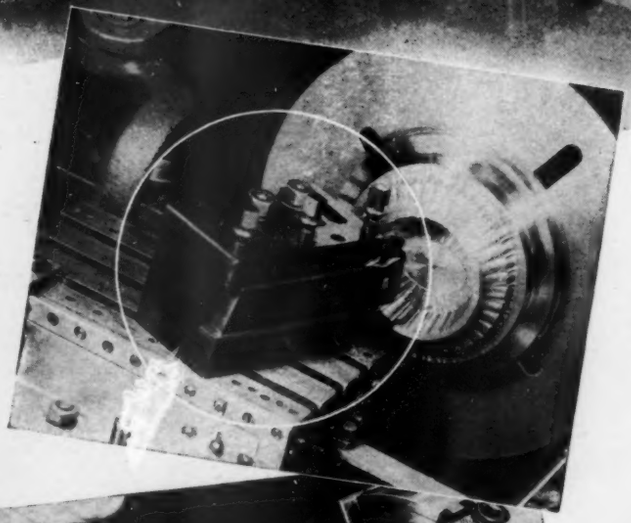
MID-WEST ABRASIVE CO.

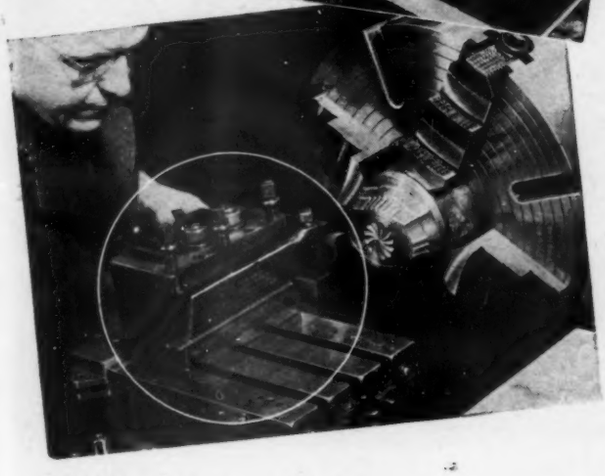
Manufacturers of DEPENDABLE Abrasives

Owosso, Mich. • Detroit • Rochester, Pa.

On a Monarch SHAPEMASTER you can turn squares, ovals and innumerable other irregular shapes with standard

ARMSTRONG
TOOL HOLDERS





The phenomenal Monarch SHAPEMASTER performs the most astonishing operations. Basically a 20" Monarch Lathe, when fitted with the SHAPEMASTER Mechanism, it will turn squares, ovals, hexagons, octagons and multiple sided shapes in irregular contour pieces. Almost any desired shape can be transmitted by the cutting point to either outside or inside diameter or face of the work.

The result of many years of engineering and development, the SHAPEMASTER is distinctly *modern* and advanced in its design in every detail. Still, for most of its unusual operations it is tooled with ARMSTRONG TOOL HOLDERS, of the standard types universally used on ordinary lathes in 96% of the machine shops and tool rooms.

These ARMSTRONG TOOL HOLDERS are selected not only because they "Save: All Forging, 70% Grinding and 90% High Speed Steel" but also because they have the strength to support the cutting edge rigidly not only against a normal down feed but against end thrust, side and torsional strain as well.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. Francisco Ave. Chicago 12, U.S.A.
Eastern Sales Office & Whse.:
199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office:
1275 Mission St., San Francisco 3, Calif.

NO MATTER WHAT YOUR
EX-Cello's Complete Parts
Production Facilities May
Be of Practical Help to
YOU!

PRODUCT MAY BE

XLO

EX-CELL-O *for* PRECISION

Facilities and Services for Miscellaneous Production Parts

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

PRODUCTION MACHINES

Multiple Vertical Turret Lathes • Multiple Spindle Automatic Screw Machines • Single Spindle Automatic Screw Machines • Hand Screw Machines • Engine Lathes • Centerless O.D. Grinders • Centerless I.D. Grinders • Single and Multiple Spindle Drilling Equipment • Form Grinding Machines • Plain O.D. Grinders • Plain I.D. Grinders • Surface Grinders (Plain and Rotary) • Milling Machines • Thread Milling Machines • Broaching Machines (Vertical and Horizontal) • Precision Thread Grinders • Thread Rolling Machines • Precision Boring Machines • Lapping Machines • Special High Production Equipment

HEAT TREAT

Laboratory for Heat Treat Control Including Micro Examination and Photography • Induction Heat Treating • Sub-Zero Heat Treating Equipment • Atmosphere Control Continuous Hardening Furnaces • Atmosphere Control Box Hardening Furnaces • Various Types of Air-Draw Batch Type Furnaces • Pack Carburize Furnaces • Gas Carburize Furnaces • Vertical High Speed Steel Atmosphere Control Hardening Furnaces • Nitriding Furnaces • Cyanide, Lead, and Neutral Salt Pot Furnaces • Continuous Air-Draw Furnaces

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accident; that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the machining process, and that give real economy.

Few people realize how extensive are Ex-Cell-O's facilities for the speedy production of quality parts. Yet the same wide experience, the engineering "know-how", and the outstanding accuracy that distinguish Ex-Cell-O machine tools and cutting tools wherever they are used . . . in many parts of the world . . . go into Ex-Cell-O's production parts manufacture.

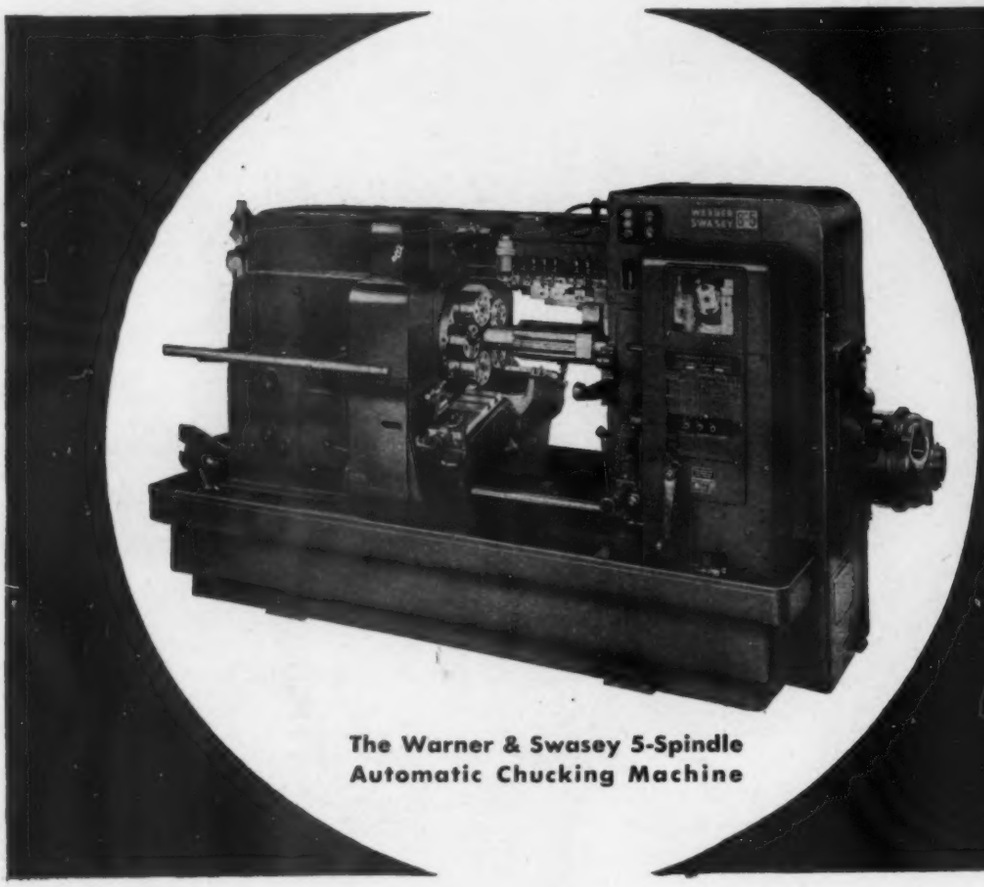
If your product requires carefully machined parts, the chances are Ex-Cell-O can work with you to your economical advantage. Contact Ex-Cell-O today, either at the Head Office in Detroit or through any one of the 27 other leading industrial centers where Ex-Cell-O field engineering representatives are located.

EX-CELL-O CORPORATION • DETROIT 6

Folder illustrating Ex-Cell-O's complete parts production facilities will be sent you upon request. Write or wire Ex-Cell-O today and ask for Ex-Cell-O Bulletin No. 36151

Announcing A NEW, IMPROVED

5-SPINDLE CHUCKING MACHINE—6" Swing



The Warner & Swasey 5-Spindle
Automatic Chucking Machine

YES, IT'S TRUE—Warner & Swasey now makes automatics! To meet an emphatic need for improved automatic design, our engineers perfected a machine that combines high precision with far faster, simpler set-up. At first, war work held up its production, but now it's ready.

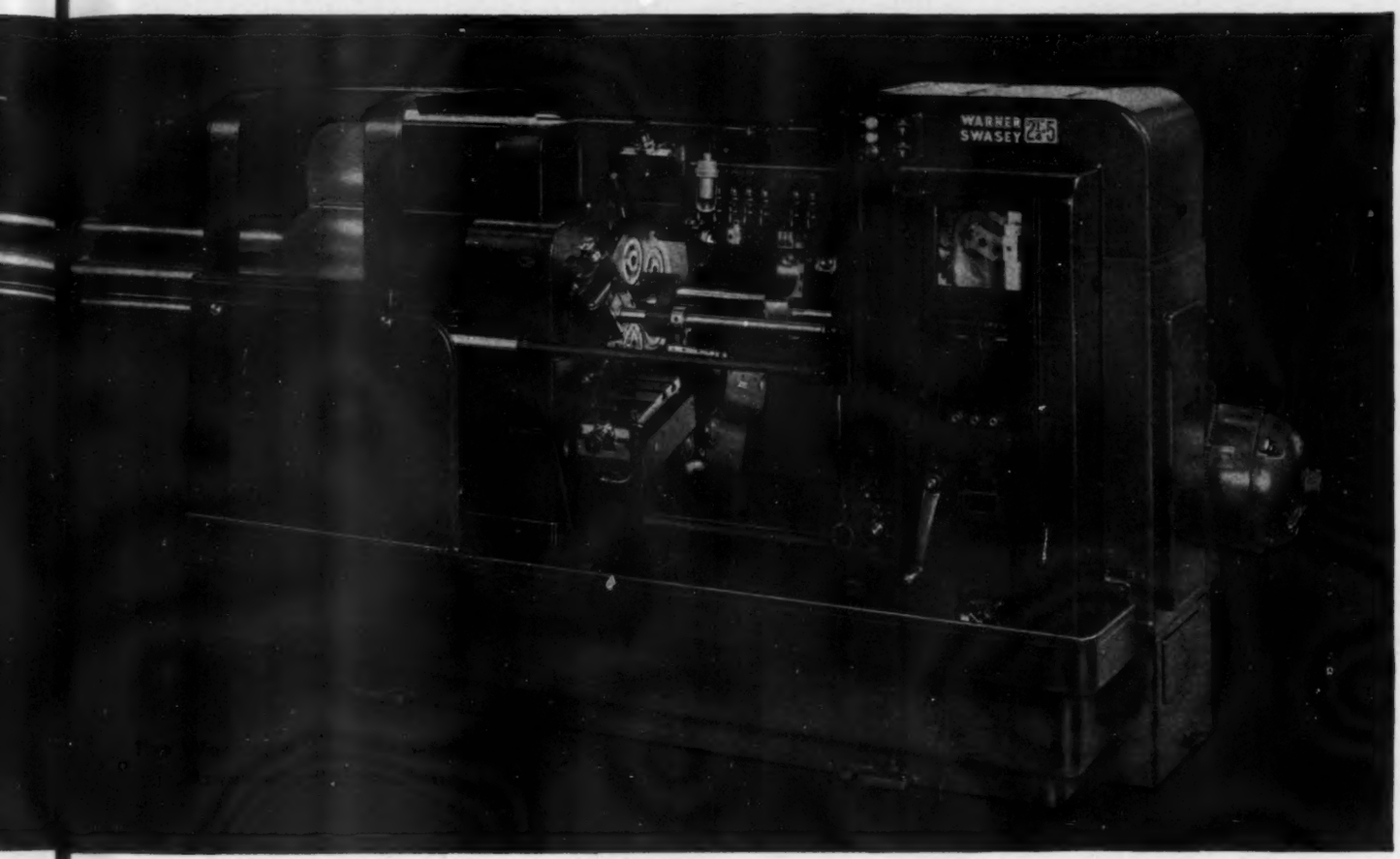
Now—using these new Warner & Swaseys—the automatic principle can be applied practicably to small and medium as well as long-run production. A patented Quick-Set mechanism eliminates forever the time-consuming changing of cams and the necessity for keeping on hand hundreds of bulky cams for a wide range of tool-stroke settings.

The same skill, craftsmanship and sound engineering that have made Warner & Swasey Turret Lathes and Precision Tapping and Threading Machines famous as profit-makers is now at work on these new automatics. You'll want full information on these new machine tools and all their great features. See your Warner & Swasey branch office or write for a descriptive folder. We cordially invite production men to come to our plant for shop demonstrations!

TURRET LATHES, SADDLE AND RAM TYPES • CHUCKING AND BAR TOOLS • PRECISION TAPPING

AUTOMATIC BY WARNER & SWASEY!

5-SPINDLE BAR MACHINES — 1¾" and 2¼"



NO CAM CHANGES

PATENTED QUICK-SET MECHANISM ELIMINATES CAM CHANGING

Simple adjustment of a stop on a graduated quadrant (left) automatically sets the permanently installed tool-stroke cams on the new Warner & Swasey automatics. No cam changing is necessary! And the patented Quick-Set mechanism makes possible an infinite number of settings.

OTHER FEATURES

- Unique spindle drum locking mechanism assures constant accuracy.
- Harmonic bar feed motion for shockless stock positioning.
- Micrometer cross slide adjustment.
- Four cross slides standard in addition to cut-off slide and two longitudinal slides.
- Unusual tool clearance and chip conveyor.
- Full-view rolling splash guards.

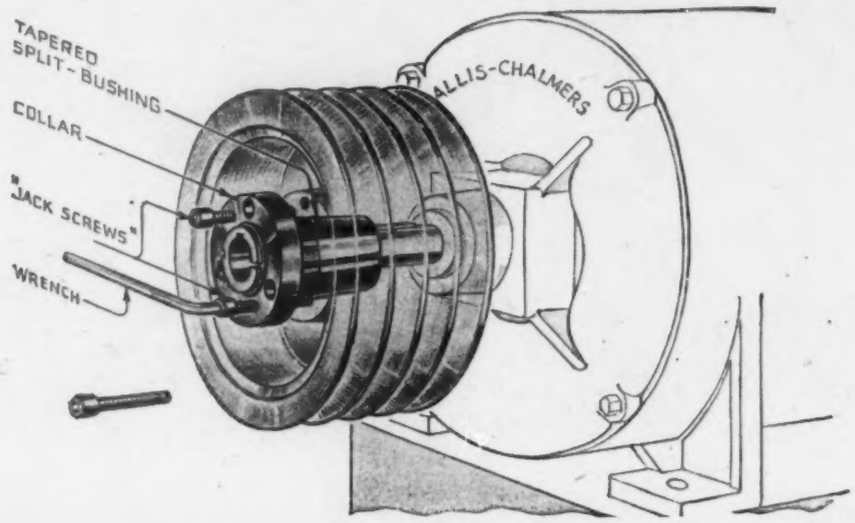
You Can Machine It Better, Faster, For Less... With a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

AND THREADING MACHINES • AUTOMATICS, BAR AND CHUCKING

It's Easy to See

THE SECRET OF THE OF THE "MAGIC-GRIP" SHEAVE



Fastest mounting and demounting sheave on the market, the new "Magic-Grip" costs you nothing extra.

SEE HOW THIS SHEAVE REMOVES EASILY, SAVES TIME AND MONEY

1 **Remove three capscrews** from bushing collar with handy wrench. Insert two capscrews. When turned, they become levers... automatically breaking the tight grip of tapered split bushing on both sheave and shaft.

2 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off... smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

RECONVERTING?

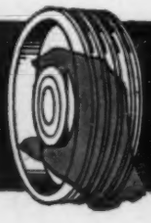
GET THIS NEW FREE KIT!

To help you find out how your present equipment will fit into future production, A-C offers a new free "Reconversion Inventory Kit" — Fact Sheets and Check Lists to speed your appraisal of V-belt drives, electric motors, and centrifugal pumps. Applies to all makes. Call your A-C distributor or district office, or write Dept. 10, ALLIS-CHALMERS MFG., Milwaukee 1, Wisconsin.

A 1859

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES



HEAR THE BOSTON SYMPHONY: *Saturday, American Broadcasting Co.*

There's Beauty in a LeBLOND LATHE

YOU: "Who cares?"

WE: "You do."

YOU: "You're off the beam. I'm interested in what a lathe can turn at a profit. I should worry about its looks."

WE: "Now we're talking the same language. The beauty of a LeBlond Lathe appears to best advantage on production cost sheets. Its accuracy, rugged simplicity of construction and ease of operation reduce scrap losses to a minimum . . . provide years of trouble-free, close tolerance operation. Let's take the LeBlond Heavy-Duty Engine Lathe for example—

"The headstock is constructed to such a degree of efficiency that it even compensates for the slightest variations of spindle temperatures. The massive tailstock with its offset handwheel is a distinct advantage over the conventional type . . . makes it easy to operate . . . permits stock to be passed through it. One piece apron —anti-friction bearings—one shot lubrication and the 'Improved Compensating Vee' type bed are among the features that make the LeBlond Heavy-Duty Engine Lathe outstanding . . .

"Write today for information on the machines you need to meet the exacting demands of today's production schedules."

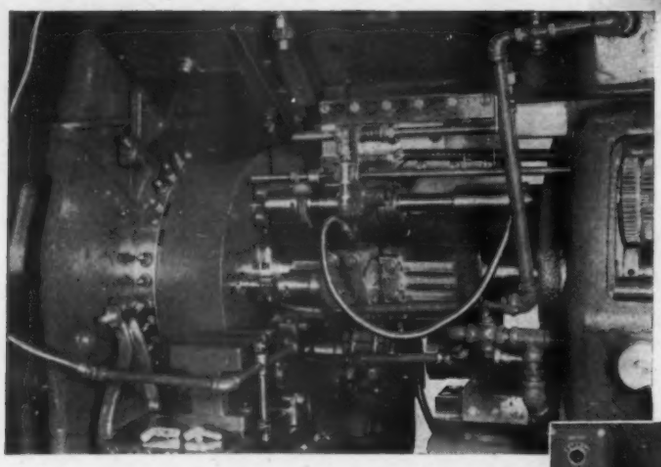
Since 1887 the world has been turning to LeBlond for turning equipment.

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO, U. S. A.

NEW YORK 6, Singer Bldg., 149 Broadway, WOrth 2-0722
CHICAGO 6, 20 North Wacker Drive, STA 5561

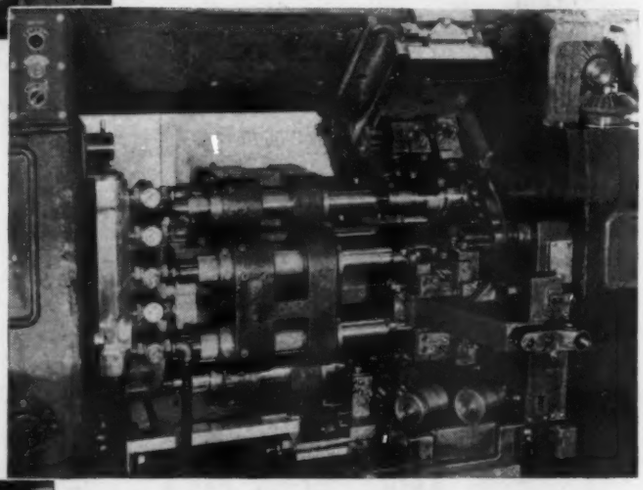
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

4 REASONS WHY ACME-GRIDLEY MEAN



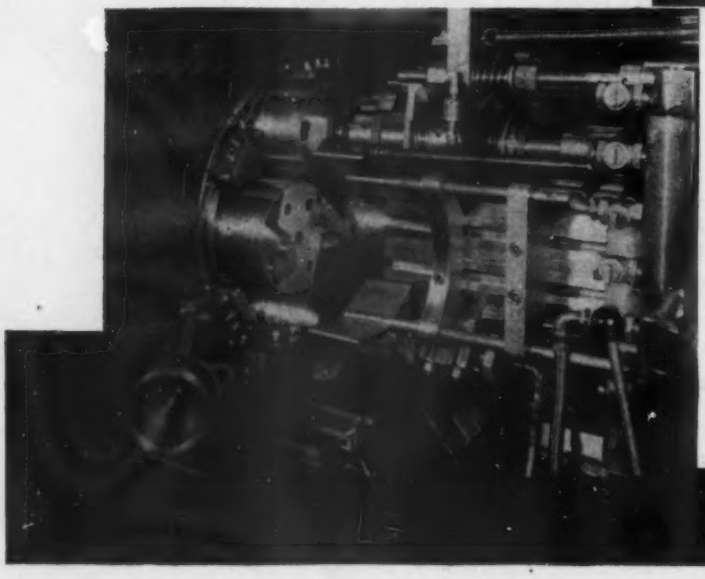
ON AIRCRAFT PARTS

Aluminum Alloy Die Cast Fitting —11 operations on 5¼"—6 Spindle machine—machining time less than 10 seconds. Must have smooth finish and near perfect concentricity of bevel and straight fitting surfaces. Pressure-tight threads cut to class three-plus fit with $1\frac{1}{16}$" Versotool. Machine equipped with air chucking mechanism.



ON PISTONS

Cast Iron Piston—12 finishing operations on 6"—8 Spindle machine. Carbide tipped tools—2 pieces per cycle of 27 seconds, double-indexing finishes two pieces at once (13½ seconds per piece). Multiple position toolholders provide for varying location of ring grooves or different groove widths, for other piston sizes.



ON AUTOMOTIVE PARTS

Malleable Iron Shock Absorber Base—(8¼" across flange x 3½" long)—22 operations on 8"—6 Spindle machine—machining time 51 seconds with carbide tools. 4¾" Namco Collapsible Tap—piloted for very close concentricity of thread diameter with O.D. Bore to bottom with square corner finish (no radius allowed). Bore and O.D. to exceptional limits of concentricity. Hook-bolt type hydraulic chucks used.

CHUCKING AUTOMATICS

LOWER PRODUCTION COSTS

1. THEY'RE FASTER!

Acme-Gridley Chuckers are designed to carry *more* tools and *more* attachments for a given job. By splitting up long cuts, by taking more cuts simultaneously you'll make important savings in machining time. Speeds and feeds are limited only by the endurance of modern cutting tools.

2. THEY'RE RIGID!

Strength, weight and rigidity are built into the machine. Acme-Gridley box-type frame and spindle carrier design assure positive alignment. This sturdy construction makes it easier to maintain accuracy even at the higher speeds and greater feeds used with carbide-tipped tools.

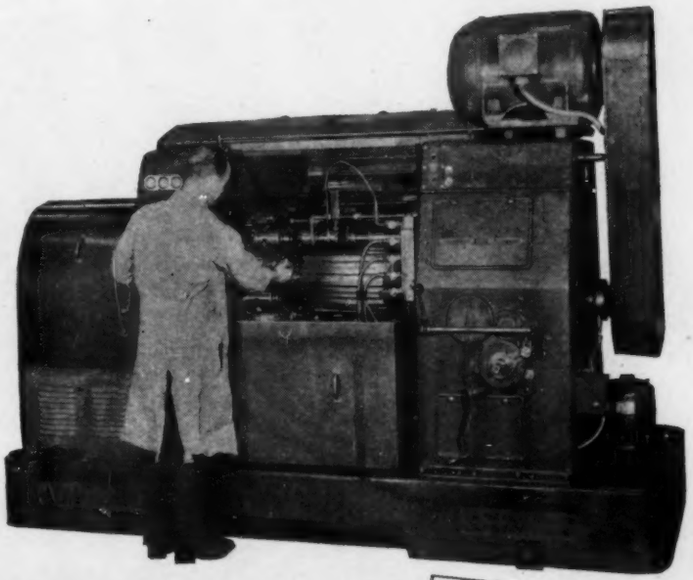
3. THEY'RE CONVENIENT!

Operators *like* Acme-Gridley Chuckers; they're designed for easy operation. The working area is waist to chest high; no bending or stooping. Tooling zones and cams are readily accessible—you can make quick tooling changes.

4. THEY'RE ADAPTABLE!

Acme-Gridley Chuckers are *not single purpose machines.* Many manufacturers are finding that a few simple changes in tooling will permit the machining of a variety of mass-produced parts for which special machines always have been an accepted requirement.

● *Acme-Gridley Chucking Automatics are built in capacities from 4⅝" to 12". Depending on size they are available in 4, 6 and 8 spindle arrangements. A new booklet "How Costs Were Cut on 25 Chucking Jobs" shows their broad-range adaptability. Ask for your copy.*



The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

We have reversed the design . . . but NOT the principle

Users agree that the Bryant principle of *cylindrical slide construction* is ideal for the fast, precise, economical production of internally ground parts. Bryant engineers knew that this same principle, applied *under the work head*, would be more practical for certain types of jobs. The result was the Bryant No. 112. This result has been *tested and proved* for the past five years.

The No. 112 is the last word for the internal grinding of tool room and small lot parts. It is designed with simple, concentrated controls — tooling and fixtures may be changed quickly — production is extremely fast — accuracy and work finish are among the finest ever produced by any grinder of any type. To help determine the value of the Bryant No. 112 on your work . . . *Send for the man from Bryant.*

PHANTOM VIEW OF BRYANT No. 112

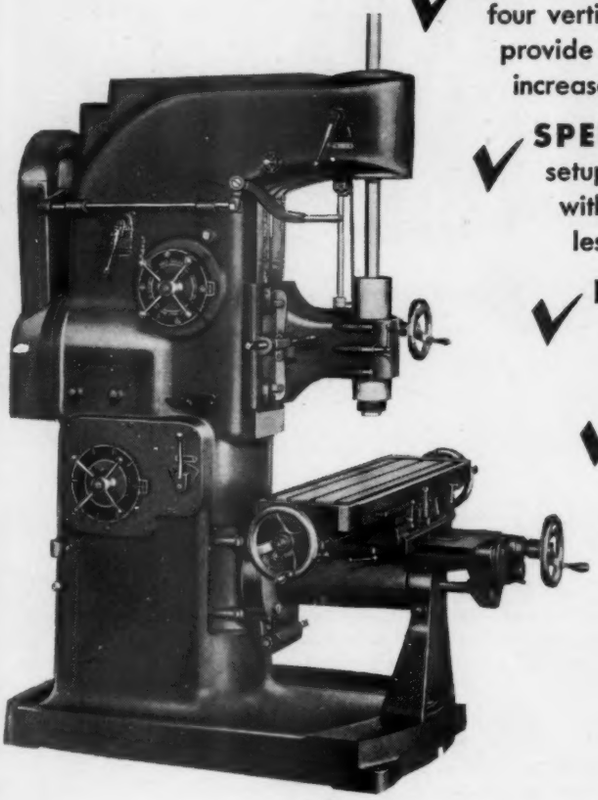
BRYANT

CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT, U. S. A.

GAIN MANY ADVANTAGES WITH A KNIGHT MILLER!

✔ **FLEXIBILITY**... Knight's ingenious tilting, swiveling table eliminates costly jigs and fixtures for holding special work in unusual or difficult positions for milling, boring or shaping.

✔ **CAPACITY**... Sixteen changes of spindle and table speeds, four vertical spindle feed changes, and the swiveling table, all provide for the use of an unusual range of cutter sizes and increased working area.



✔ **SPEED**... Moving the spindle instead of the work, reduced setup time, elimination of special setups, and quick locating with dial indicators, all mean more work in less time with less effort.

✔ **RIGIDITY**... Unusual sturdiness is assured through the one-piece backbone-and-base semi-steel, heavily reinforced column casting.

✔ **OPERATING SIMPLICITY**... Clear vision, easily manipulated, conveniently located controls for direction, speeds or feeds, mean fast, efficient operation.

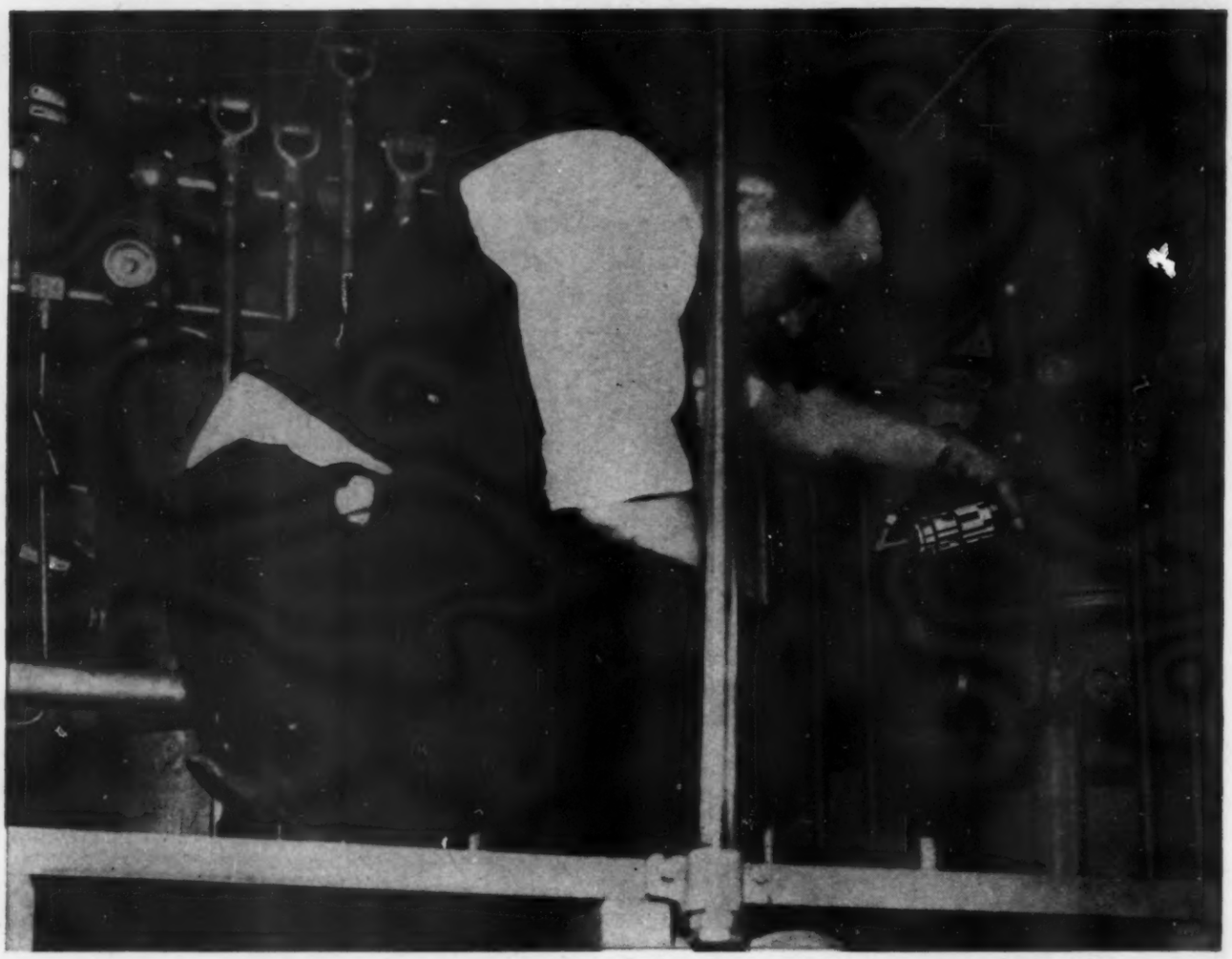
Combining *all* the advantages of capacity, flexibility, accuracy, speed, ruggedness, and easy operation, Knight Millers offer many opportunities for achieving unusual output as well as some surprising savings in cost and labor.

Write today for catalog and complete information...

KNIGHT VERSATILE MILLERS ACCURATE RIGID

W.B.KNIGHT MACHINERY COMPANY

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI



He's reading the "Blood Pressure" of a giant Diesel engine

. . . with the help of Veeder-Root COUNTROL

This unique instrument is designed to help power engineers and maintenance men keep Diesel engines running at peak efficiency. Simply by a "twist of the wrist," the operator obtains an accurate maximum pressure reading on the indicator's clear, easy-to-read Veeder-Root Counting Device.

The instrument's operation is based on the principle of balancing the maximum cylinder pressure by the force of a precision spring, and then measuring deflection of the spring. Cylinder pressure acts against the bottom of a ball piston which is held on its seat by the force of this spring. Now, spring-tension is reduced by turning the indicator handle until cylinder pressure offsets spring pressure. At this instant the handle locks in position and the operator can read—directly, in pounds per square inch—the Veeder-Root Counting Device to which the handle is geared. No mistakes can be made. No adjustments or settings are needed to compensate. Accurate readings up to 1700 pounds per square inch can be taken instantly and directly from the Veeder-Root Counter... on any type of Diesel, at any speed and rate of pressure rise.

This is an interesting instance of the infinite ways in which Veeder-Root Counting Devices can be designed and built into all types of products, as integral parts, to help those products deliver a distinctive, exclusive service. And it would be interesting, too, to see what Veeder-Root "*Count*rol" might do to add new utility *and marketability* to *your* products, present or projected—or both. Write.

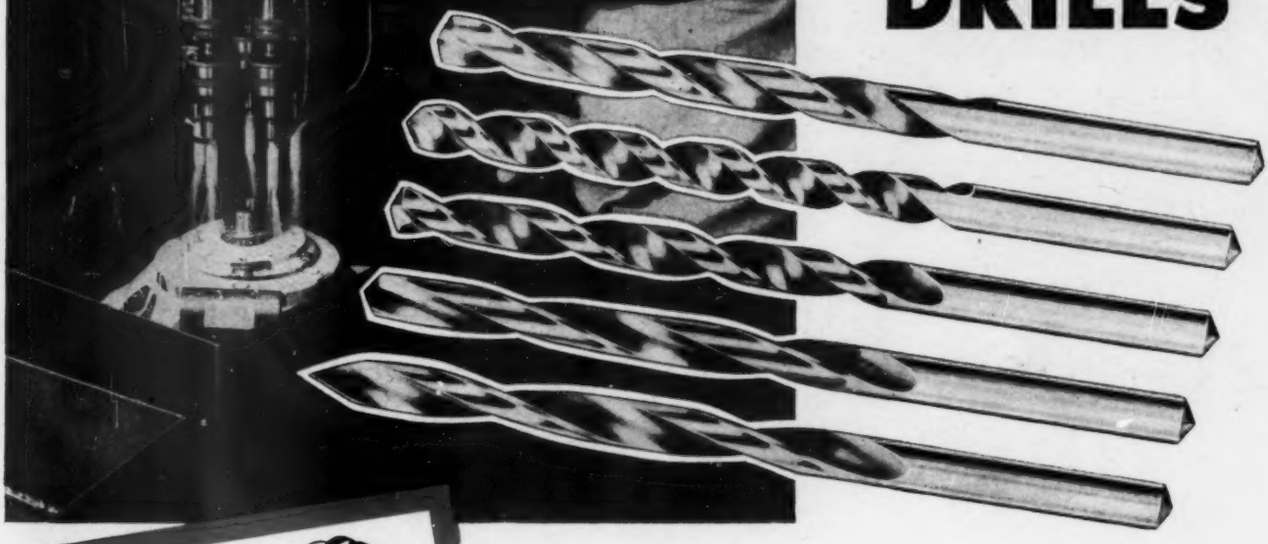
The Counting House of Industry

VEEDER-ROOT INC.

Hartford 2, Connecticut

In Canada: Veeder-Root of Canada, Ltd., Montreal
In England: Veeder-Root Ltd. (New address on request)

FACTS about TWIST DRILLS



Call Your DISTRIBUTOR!

Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory-trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

MANY drills differ in design from the standard twist drill. Because of their wide applications some types have become semi-standard, and are carried in stock in certain sizes. Among the best-known are deep hole fast spiral drills, plastics drills, cotter pin drills, and screw machine or brass drills.

Whether your twist drill requirements are standard or special, you will find it to your advantage to specify NATIONAL tools—the National choice.

NATIONAL

NATIONAL TWIST DRILL & TOOL — ROCHESTER, MICH., U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS
END MILLS

TWIST DRILL AND TOOL COMPANY

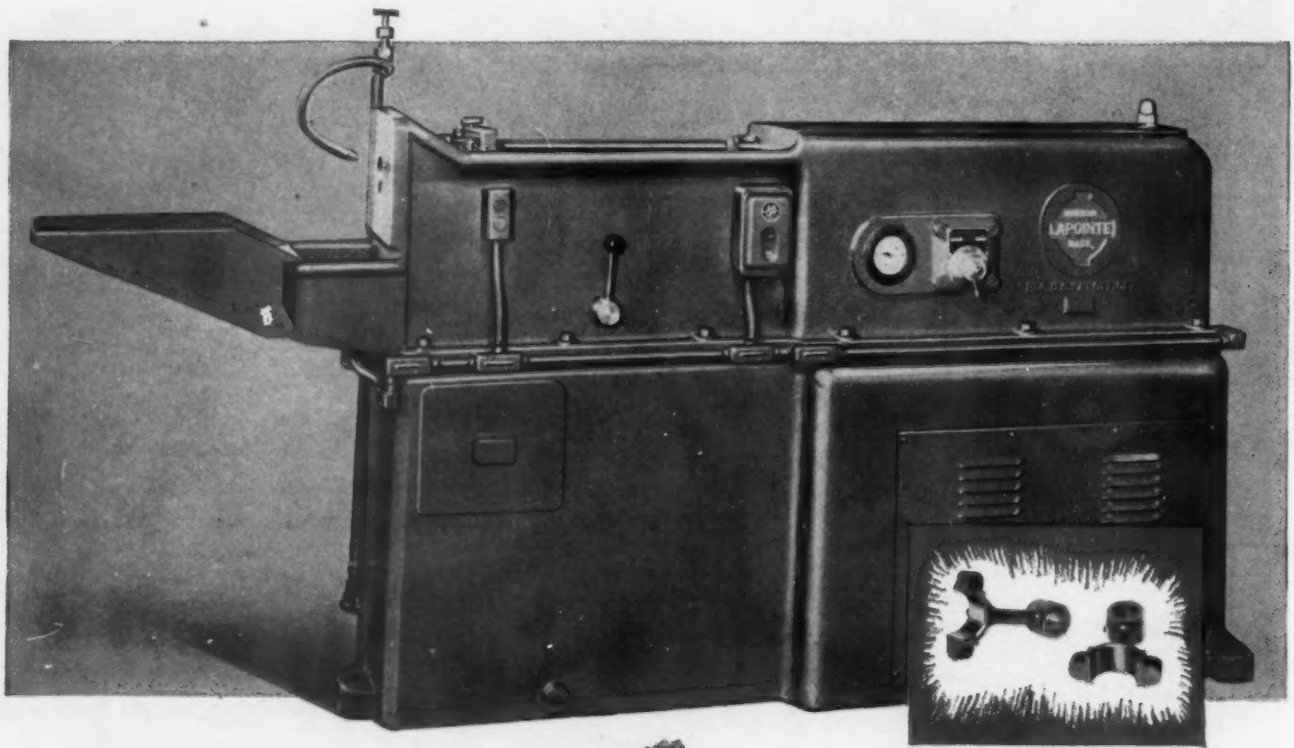
ROCHESTER, MICH., U.S.A.

Tap and Die Division — Winter Bros. Co.

Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco • Distributors in Principal Cities

The NEW "MIGHTY MITE" for Mass Production!

Smooth flowing, hydraulic power gives maximum production to this 24 inch stroke, 2½ ton pull machine. Ideal for small parts mass production, Lapointe's HP-5 has already demonstrated material savings in (1) tool costs, (2) time per man per part, (3) floor space, (4) spoilage, (5) greater precision. If your small part production calls for microtolerance, greater and quicker production with substantial tool cost savings, investigate Lapointe's HP-5. A full range of speeds, semi-automatic controls with special fixtures give versatility and more economical precision production. Write Box AM-14 for your copy of "Broach and Tool Sharpening" — the latest authoritative publication on tool and cutter sharpening.



Bronze Compressor Bearings.

Flat surfaces and Bearing seats broached.

Typical of jobs which can be done on the HP-5.

★

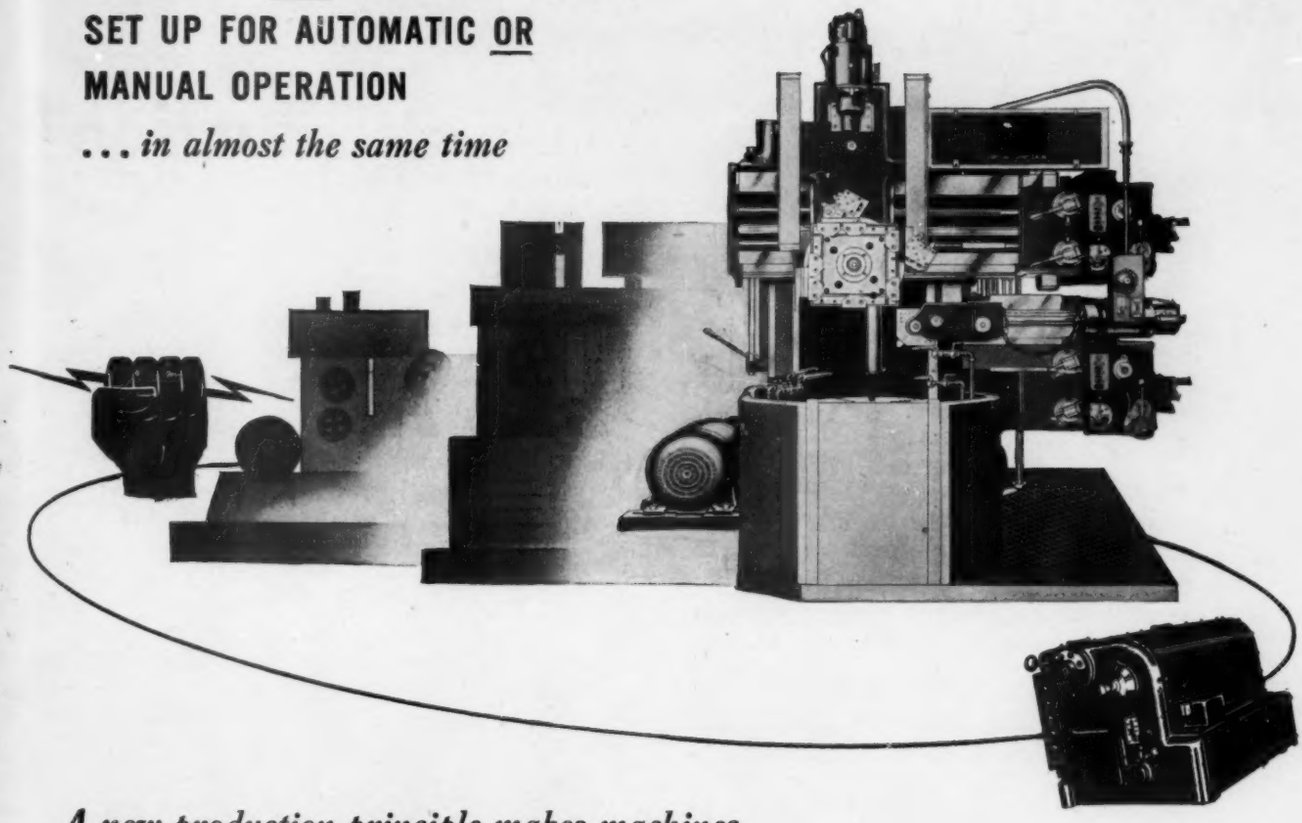
THE Lapointe MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

NOW... ONE MACHINE CAN BE SET UP FOR AUTOMATIC OR MANUAL OPERATION

... in almost the same time



A new production principle makes machines yield richer returns on investment

The Bullard MAN-AU-TROL principle of automaticity gives a machine the ability to be changed from manual operation on single pieces or small job lots . . . to automatic production runs . . . in only slightly more time than required for changing the setup of a manually-operated machine . . . To illustrate, picture the operation of a Bullard MAN-AU-TROL Vertical Turret Lathe. Suppose a sample is to be machined for approval before a long run is started. As the operator does the first piece with the machine under manual control, he makes a simple MAN-AU-TROL setting at the end of each function. The job is completed in only a slightly longer time than if no settings were made. When approval is obtained, the operator then moves a single lever and operation becomes 100% automatic. Now, in between schedules of production runs, he can cut out automatic operation and use the machine for hand operation on miscellaneous jobs . . . This revolutionary machine versatility which prevents a machine from ever being idle is due to the fact that MAN-AU-TROL merely takes over whenever the manual operator wills, without disturbing the machine's inherent versatility. MAN-AU-TROL is now being applied only to Bullard machines.

The Bullard Company, Bridgeport 2, Connecticut.

The automatic control that is as versatile as manual control

100% automaticity . . . 100% versatility . . . no human or cumulative error . . . control to the closest tolerances . . . a tremendous cost advantage in competitive markets.

Precisionized

with

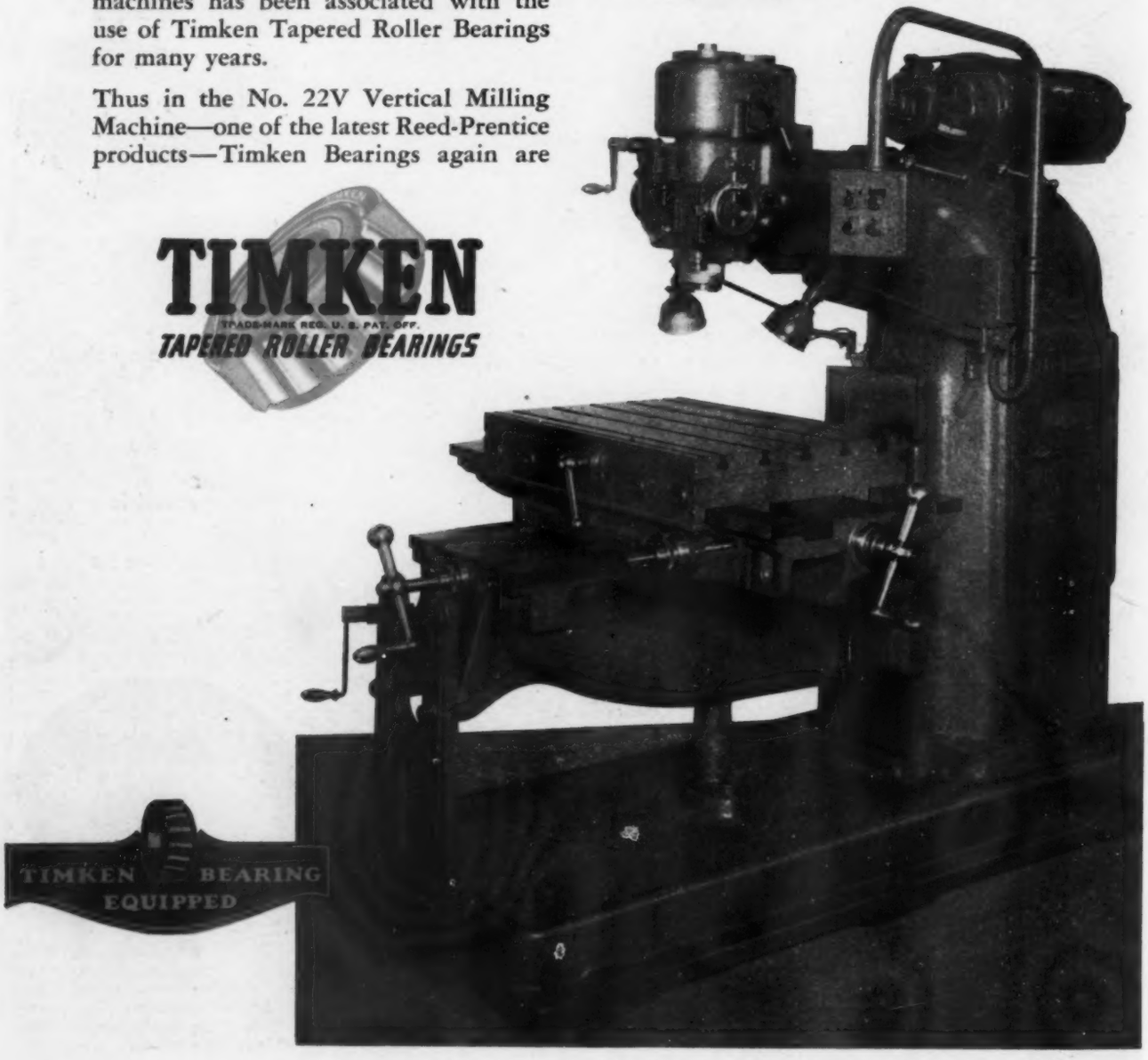
TIMKEN BEARINGS

The name of the Reed-Prentice Corporation ranks high in any estimation of precision as applied to heavy duty machine tools. Precision, in Reed-Prentice machines has been associated with the use of Timken Tapered Roller Bearings for many years.

Thus in the No. 22V Vertical Milling Machine—one of the latest Reed-Prentice products—Timken Bearings again are important factors of Reed-Prentice performance, comprising precision, speed and economy.

Eight of them are used on the head shafts of this machine, including the spindle. Their presence is sure protection against friction; wear; radial, thrust and combined loads; and misalignment.

You need these benefits in your machines. To be sure of getting them, look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.



These fellows have GOT something!

They're your direct factory representatives for Sossner's amazing MIRROR FINISH TAPS!

OHIO—Henger-Fairfield Co.—1812 Columbus Road, Cleveland 13; 124 East 7th Street, Cincinnati 2; 1216 U. S. Building, Dayton 2

EASTERN PENNSYLVANIA—Pottstown Tool and Engineering Co.—409 Security Trust Bldg., Pottstown

WESTERN PENNSYLVANIA—James H. Cross Co.—2765 West 8th Street, Erie

ILLINOIS and IOWA—H. S. Huncke and Co.—230 West Huron Street, Chicago 10

INDIANA—Frank Burgan—307 West Sherwood Terrace, Fort Wayne 6

SOUTHERN MICHIGAN—Tool Supply Co.—40 Custer Avenue, Detroit 2

WISCONSIN—Putrow Industrial Service—P. O. Box 557, Oshkosh; 161 West Wisconsin Ave., Milwaukee 3

WESTERN NEW YORK—Leo F. Dwyer—50 Suburba Avenue, Rochester 12

OKLAHOMA, KANSAS, ARKANSAS and NORTHERN TEXAS—General Iron and Steel Products Co.—P. O. Box 3128, Tulsa 8, Oklahoma

WASHINGTON and OREGON—C. T. Hanes Co.—1507 2nd Ave., Seattle 1, Wash.

These Sossner direct factory representatives are trained to discuss your tap requirements, and to keep you informed on the latest in tap developments.

MIRROR FINISH

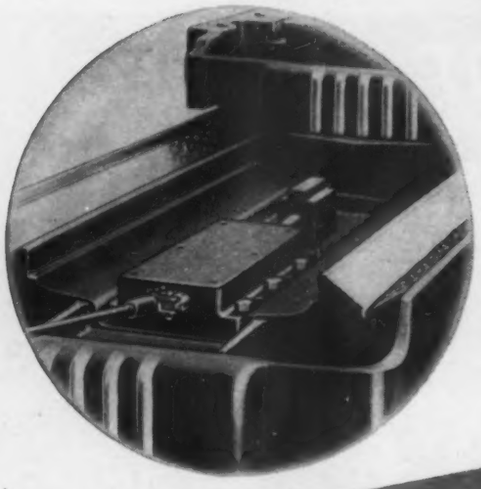
FOR FINER PART FINISH

TAPS • STEEL STAMPS • DIES AND MOLDS

SOSSNER

161 GRAND STREET, NEW YORK 13

or 27 BROADWAY, LYNBROOK, N. Y.



Designed for greater safety at higher speeds

It is now possible to obtain a positive hydraulic safety stop and jack to completely protect anything around the machine in case of complete failure of the electrical control.

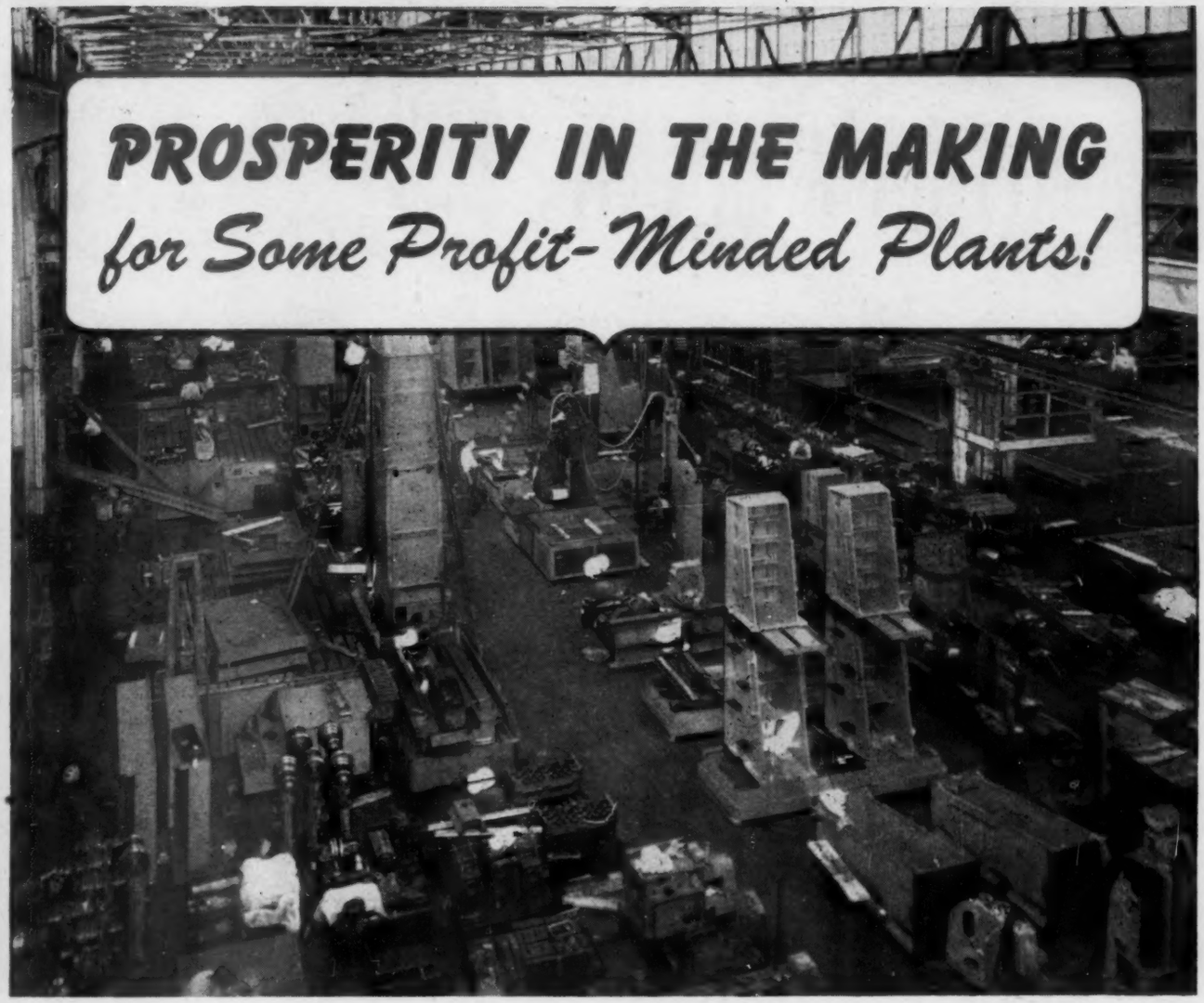
This safety stop is designed to stop the table quickly in case of control failure with a uniform decelerated motion without severe shock to parts of the Planer. All parts are completely enclosed to protect them from dirt and chips so there is no chance of failure.

This stop also is used as a jack for relocating the table over the bull wheel by inserting a handle in the stop and pumping the table back to its running position. No crane or other means, therefore, is required for this operation which invariably results in damage to the gear teeth.

After the stop is used it automatically resets itself. The operator or maintenance department does not have to replace any parts or reset any mechanism, thereby saving time and eliminating the human element.

HYPRO PLANER
Positive Hydraulic TABLE STOP

THE CINCINNATI HYPRO PLANER COMPANY
PLANERS · BORING MILLS · PLANER TYPE MILLERS
CINCINNATI, OHIO



PROSPERITY IN THE MAKING
for Some Profit-Minded Plants!

As you read this advertisement . . .

These Keller machines have been completed and shipped to American plants . . . are already working on new dies and pilot model parts. They are major factors in speeding reconversion . . . helping their owners get a head start on competition.

Keller machines do an uncanny job. They reproduce intricate shapes . . . either two or three dimensional die cavities or actual complicated parts. They work from a master form made of wood, plaster or any similar easily worked material. As the sensitive electrically-controlled tracer feels out this master, the cutter duplicates that form, carving it into tough die steel, Duralumin or any desired material. The Keller machine is the means of side-stepping costly tooling on pilot model parts, or producing intricate dies in fast time to meet production schedules.

There is a Keller machine the right size for every shop, from the smallest "G" machine up to the 97-ton giant "BG-3". We will be glad to answer questions, send you literature, show you what Keller methods can do on your work. It can pay for itself in many ways in a surprisingly short time.

PRATT & WHITNEY

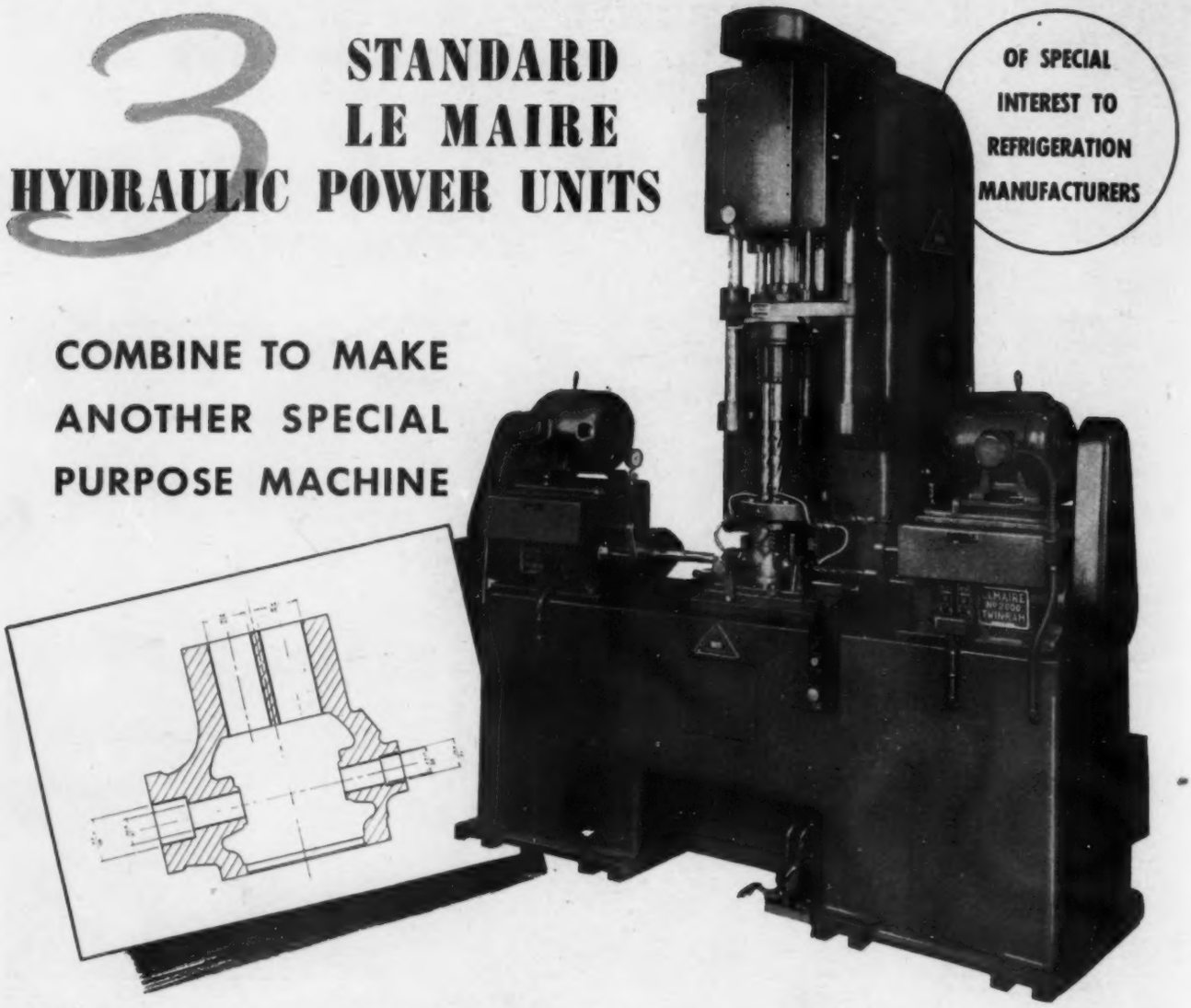
Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

3 STANDARD LE MAIRE HYDRAULIC POWER UNITS

OF SPECIAL INTEREST TO REFRIGERATION MANUFACTURERS

COMBINE TO MAKE ANOTHER SPECIAL PURPOSE MACHINE



THREE No. 2000 Twin Ram Hydraulic Units compose the power factor of this new 3-way drilling machine. All are mounted on a standard base—two opposite each other in horizontal position and one vertical in a column between.

The machine was designed to drill four holes in cylinder blocks for refrigerator compressors.

Two vertical holes for the cylinders are 1⅛. The horizontal holes for the crankshaft are made with multi-diameter drills ⅝–⅞ and ⅝–1⅛.

A simple adjustment of the special indexing type multiple head can change the setup for drilling either single or twin cylinder block.

Production of 90 pieces an hour has been attained.

The Le Maire Hydraulic Unit is a compact power package that can give a wide range of spindle speeds, feeds and dwell you require.

You can provide yourself with a special purpose machine easily and economically. Send for folder giving more information.

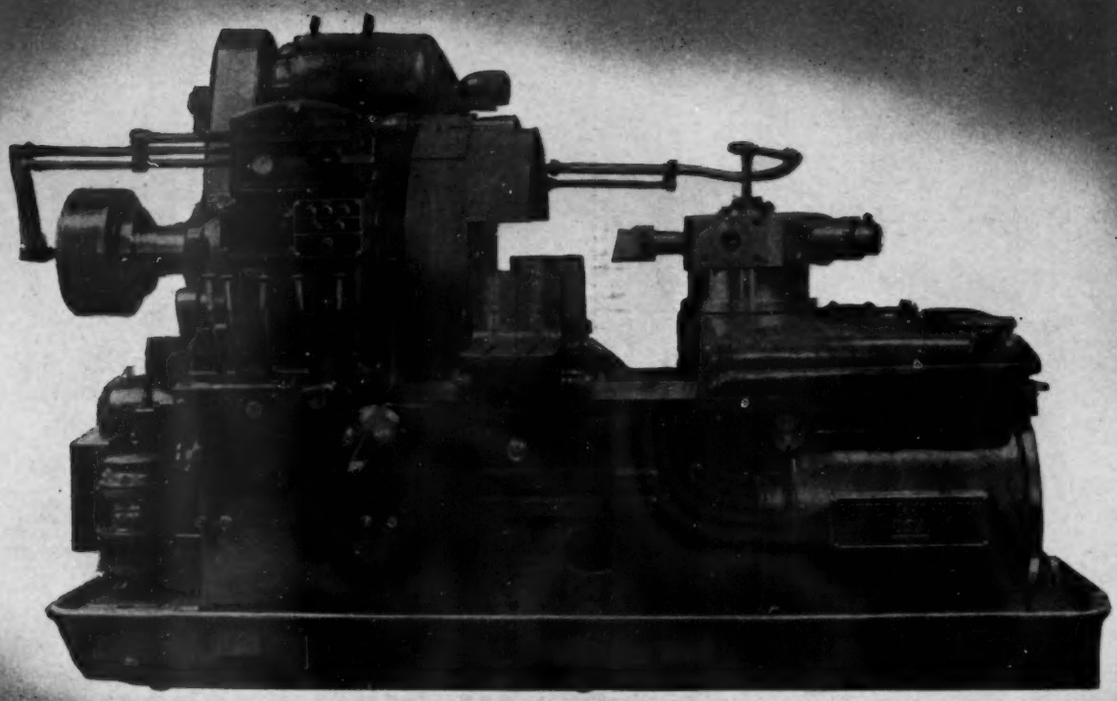
LE MAIRE PRECISION PRODUCTS

LeMaire

BUILDERS OF
SINGLE AND MULTIPLE SPINDLE MACHINES FOR BORING, DRILLING, REAMING, TAPPING, ETC.—TWIN RAM HYDRAULIC UNITS—MATCH-IT GEAR CHUCKS

LEMAIRE TOOL & MFG. CO. • 2657 S. TELEGRAPH ROAD • DEARBORN, MICHIGAN

P&J 6D *REL & RELX* AUTOMATICS



LARGE WORK *is produced in quantity* AT LOW COST *on these machines*

EVERY VICTORY BOND IS A GOOD BUY, BUT MORE ARE BETTER

Advanced features of design are incorporated in these machines which cut costs and simplify the production of large duplicate parts. Versatility in tooling possibilities adapts these machines for economical use on an unusually wide range of work.

Contributing to the increased output and high quality of work produced on these machines are inherent power and rigidity together with four automatic changes of spindle speed, three selective automatic changes of feed, automatic binding of turret following index, direct cross slide action and a motor-driven constant fast motion to cross and turret slides.

These and other outstanding features are fully described in Bulletin 118 available on request.

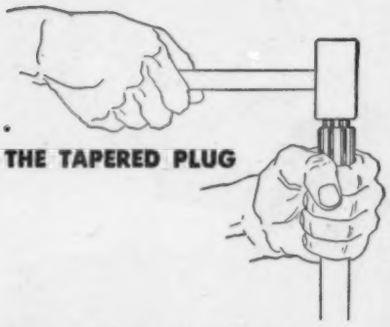
CONDENSED SPECIFICATIONS

	6D REL	6D RELX
Swing over Bed	34½"	34½"
Swing over Cross Slide	21"	21"
Cross Slide Travel (easier way)	8½"	6¼"
Number turret faces	5	6
Dia. hole in turret	2½"	3"
Turret Feed	13"	22¼"
Turret Slide Adjustment	10⅛"	17"

POTTER & JOHNSTON MACHINE COMPANY

Pawtucket, R. I.

Staples CARBOLOY-TIPPED EXPANSION REAMERS



TO EXPAND . . .
JUST DRIVE IN THE TAPERED PLUG

PRECISION . . .

again and again and again— WITHOUT REGRINDING

Expand the solid body of a Staples *exclusive* Expansion Reamer. Tilt back the diamond-lapped Carboloy Cemented Carbide cutting edges. Do this again and again, without regrinding . . . and get precision every time.

Instead of regrinding, simply drive in the tapered plug and increase the diameter of the reamer to compensate for the amount that has worn.

The patented Staples Expansion Reamer is made with a one-piece body—not split. This means rigidity—and rigidity means precision. Your results are finer finish, longer tool life . . . real economy.

This exceptional tool met the exacting standards of wartime construction. It is one of a line of quality circular cutting tools used wherever very close tolerances are held. Standard tools in stock for immediate shipment. Special tools designed.

Staples Tool & Engineering Co.
Cincinnati 25, Ohio

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

Today-

Your *Standard*
GATES VULCO ROPES

Are Giving BETTER SERVICE

Than *ANY* V-Belts Ever Built Before!

To meet the needs of our Army's tanks, tractors and self-propelled big guns in combat service, it was necessary to develop V-Belts far superior to any that had ever been built before. Gates developed and built these greatly superior V-BELTS—and here is why this fact is important to you:--

Here is the reason ➘ **Every improvement developed by Gates for these Army V-BELTS has been added, day by day, to the quality of the standard Gates Vulco Ropes which have been delivered to you.**

This is one of the very few instances in which improvements developed primarily for military use could be passed on immediately to you. Ordinarily, you would have had to wait. But in the case of Gates V-belts it was clearly recognized that industry simply had to have the best V-belts that could be made in order to maintain the production volume that was essential to winning the war.

That is why Gates has been able to pass on to you, day by day, every V-belt improvement developed for our armed forces during the war—and that is why your Standard Gates Vulco Ropes are today outperforming any V-belts ever built before!

All Gates V-Belts are Built With

The Patented
CONCAVE SIDE

Gates

THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER COMPANY

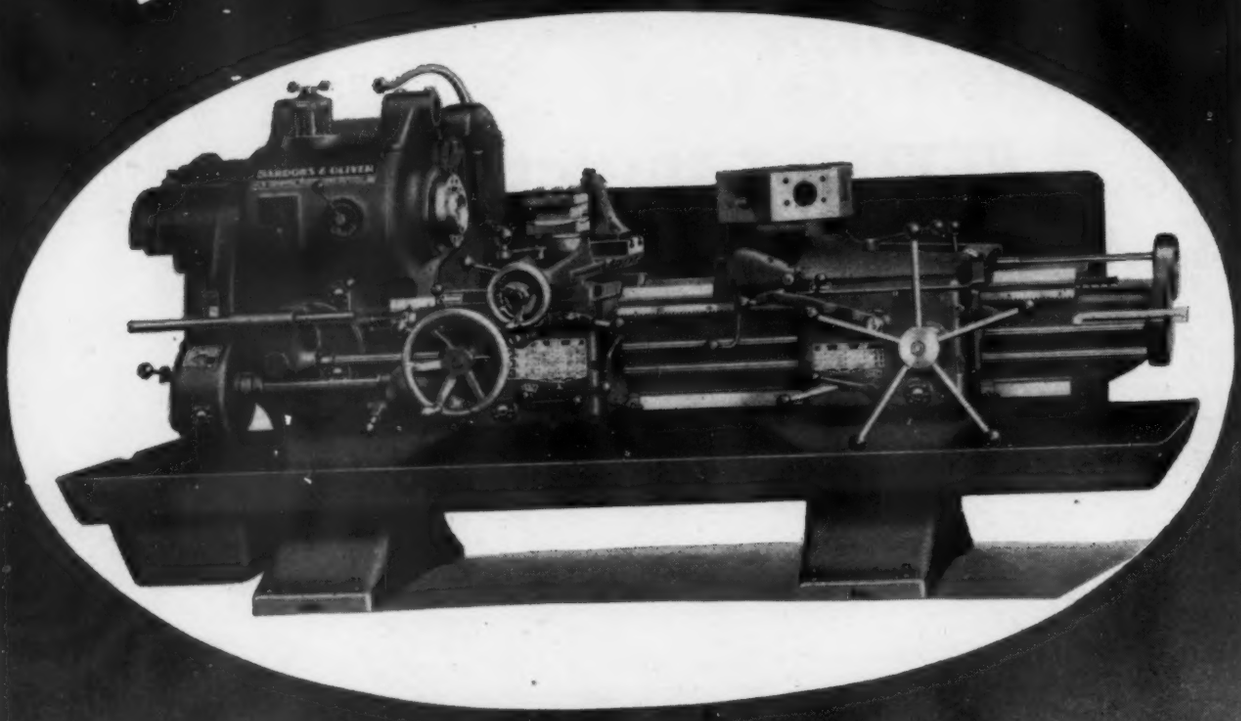
Engineering Offices and Jobber Stocks in All Large Industrial Centers

461

GATES VULCO ROPE DRIVES

CHICAGO 6, ILL., 549 West Washington. NEW YORK CITY 3, 215-219 Fourth Avenue. ATLANTA 3, GA., 521 C. & S. Nat'l Bank Bldg.
LOS ANGELES 21, CAL., 2240 E. Washington Blvd. DENVER 17, COLO., 999 S. Broadway. DETROIT 2, MICH. 223 Boulevard Bldg.
PORTLAND 9, ORE., 333 N.W. 5th Ave. DALLAS 2, TEXAS, 1710 N. Market St. SAN FRANCISCO 3, CAL., 170 Ninth St.

No. 21 *Saddle Type* TURRET LATHE



High Standards

OF WORKMANSHIP AND PERFORMANCE

MAKE THIS BARDONS & OLIVER TURRET LATHE

AN OUTSTANDING INVESTMENT . . . .

BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

"HERE'S THE TOOL FOR COST-CUTTING PERFORMANCE!"

In minimum spoilage, faster cutting and longer life between sharpenings, Morse Tools help cut production costs with the same efficiency they cut away metal.

MORSE THERE IS A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

Continental
CUTTING TOOLS

- Boring Bars and Tools
- Broaches Broach Pullers Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

CONTINENTAL TOOL WORKS
CTW
EX-CELL-O CORPORATION
52—79

The *Right* Tool Where and When You Want it

CONTINENTAL *Counterbore sets . . .*

. . . consisting of carefully selected variations and sizes to provide the most practical and economical combinations for toolroom use . . . are proving favorite cutting tools in all kinds of machine shops. Continental interchangeable counterboring and spotfacing tools have a wide range of uses. Two standard sets are shown below. Write to Continental today for details.

Above: Set No. 2, for the average-size toolroom.

To right: Set No. 3, for general needs of larger shops.

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

Send for Bulletin No. 55

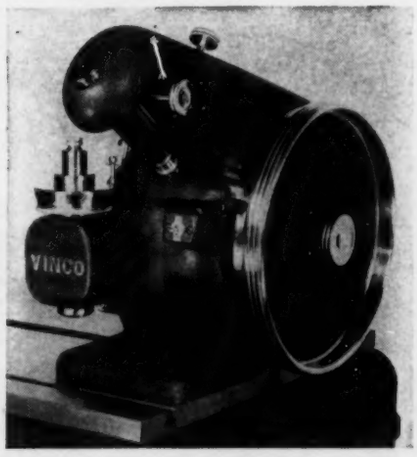
30 Times MORE ACCURATE

What does that mean to you? It means that this proven accuracy is available to you for the inspection of gear teeth, master index plate notches, splines, cams and any other form of angular spacing. It means that final assemblies involving gears, cams, splines, etc., will be subject to less scrappage, because angular spacing errors will have been found and corrected.

Vinco guarantees the OPTICAL MASTER INSPECTION DIVIDING HEAD to be accurate within two seconds of arc; the master disk graduations to be spaced to an accuracy within ONE SECOND of arc; and the ball bearing spindle runout to be within TWENTY-FIVE MILLIONTHS of an inch, total indicator reading (the majority of spindles have less than fifteen millionths runout).

The fact that the VINCO OPTICAL MASTER INSPECTION DIVIDING HEAD has become firmly established throughout industry in such a short time is proof of its dependability and industrial necessity. The following pages cite one of many actual cases where the VINCO OPTICAL MASTER DIVIDING HEAD played a vital role in the production of a toothed part.

Below is the dividing head proper, showing the micrometer, scope, and hand wheel.



MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

They Came to

Check These Against Your Present Needs

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Roller Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

VINCO

BECAUSE THEY WERE STUMPED BY A REAL "TOUGHY"

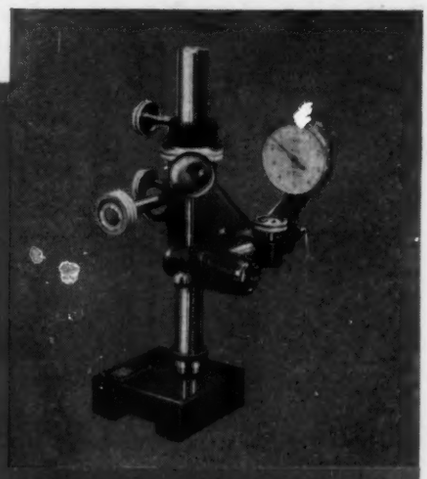
It wasn't unusual! This group of production engineers, representing a large eastern manufacturer, had used our precision production service before and were well acquainted with Vinco methods and Vinco results.

Their request was not an ordinary one however! We were asked to produce, in quantity, mating toothed parts with 18 slots, each slot .017″ in width with a tolerance of .0003″ and a root diameter held to a uniformity of .0001″.

These parts were produced exactly as specified and were delivered on time and in quantities over and above specified requirements. We cite this one instance only because it is informative. Our long experience in the production of precision instruments and finely finished gages has given us a decided edge on precision production methods and techniques. Equipment and machines of our own design and make, in the capable hands of highly skilled operators, an engineering force thoroughly grounded in every phase of precision design and construction and a sales organization made up of men who combine a full engineering background with a wide and intimate knowledge of the trends and developments in the industrial field are all valid reasons for a further inquiry regarding this important phase of modern production.

Precision parts by Vinco meet your specifications. Give us the chance to prove it.

The Vinco Standard Indicator Surface Gage



Features of this gage include a .0001″ custom built, full jeweled, dial indicator—differential adjusting screw for final settings—1½″ to 12″ work height range—full 360 degree swing of indicator head—readings can be taken on upper or lower surfaces.

Extreme accuracy and flexibility of operation all combine to make this standard indicator gage practically indispensable wherever rapid and close inspection of surfaces is required. (Incidentally, it was used regularly for checking the job mentioned above.) We designed these indicator gages for use with the Vinco Optical Master Inspection Dividing Head, but because of increasing requests they are now offered for general sale.

Vinco Universal Dividing Head

Developed by Vinco to handle light machining or grinding, this universal dividing head played a vital part in the manufacture of the "Toughy". A ratio of 1440 to 1 between handle and work spindle provides an extremely high degree of spacing accuracy, even when using standard commercial dividing head plates.

The dividing head can be mounted either vertically or horizontally. It features a large diameter spindle mounted in a double row of Vinco designed ball bearings, a tapered spindle nose for work adaptors, a face plate of 11″ diameter, a graduated dial on the spindle for initial settings, an auxiliary resetting dial and a 11.459″ pitch diameter helical gear index plate with 360 accurately spaced teeth.

Time-honored abrasive products are now further distinguished by *a renowned name*

SIMONDS ABRASIVE CO.

For more than half a century the name Abrasive Company has been synonymous with high quality grinding wheels and abrasive products. With the years has come a tremendous increase in the use of such products and the unqualified trademark designation "Abrasive" is now inadequate as a general term to distinguish this old company. Therefore, in order to establish a more distinctive identity for the organization, a more individual crest for its quality and service, the name Simonds, renowned for over a century for excellence in cutting tools, will designate product and company.

Operating under the same management and policies, SIMONDS ABRASIVE COMPANY will continue to turn out the same products of top performance which so distinguished the Abrasive Company during the past half century. SIMONDS ABRASIVE COMPANY goes forward, pledged to continue to justify the confidence of its old customers and to merit and inspire the patronage and good will of new ones.

SIMONDS ABRASIVE CO., TACONY AND FRALEY STS., PHILADELPHIA 37, PA.

The New HARDINGE High Speed Precision Second Operation Machine

You need this machine for rapid and accurate production of parts requiring secondary operations

1" COLLET CAPACITY
9" SWING; SPEEDS TO 4000 R.P.M.

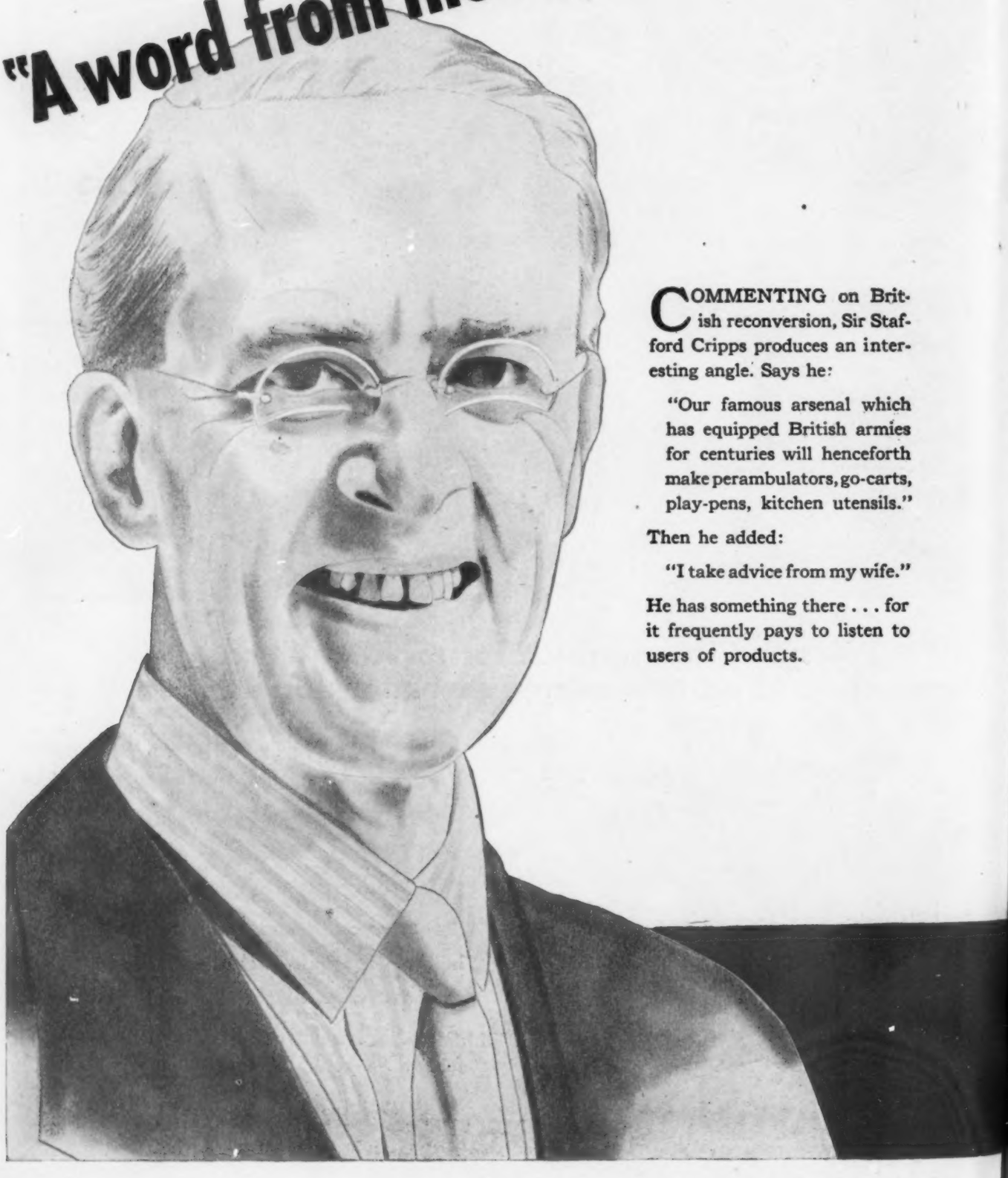
Above is a typical production run. The cross slide has a lever turning slide and a multiple tool bit holder. The turret is double-tooled — *all standard tooling for quick set-up.*

Other features are: Hardened and ground steel dovetail ways, Hardinge center-drive preloaded ball bearing spindle, preloaded ball bearing turret head and hardened and ground turret slide ways. Write for bulletin DSM59 regarding additional features.

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.

then he said to himself:

"A word from the wife is sufficient"



COMMENTING on British reconversion, Sir Stafford Cripps produces an interesting angle. Says he:

> "Our famous arsenal which has equipped British armies for centuries will henceforth make perambulators, go-carts, play-pens, kitchen utensils."

Then he added:

> "I take advice from my wife."

He has something there . . . for it frequently pays to listen to users of products.

"Take Advice"... *he says*

LOOK, SIR, how the interests of both buyer and manufacturer have been served by the Welded Design of this tapping machine frame:

ADVICE FROM SALES MANAGER:

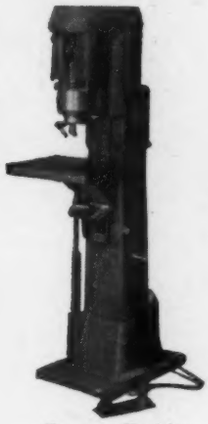
"WELD IT FOR SALES!"

RESULTS:

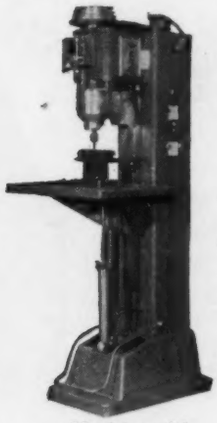
Rigidity of welded frame permits standardization of all models with single frame size. Formerly required 5 different frames. *Quicker deliveries.*

Former design required cross-ribbing for rigidity; made accessibility of parts difficult. Rigid, welded frame is open, *simplifying adjustments and maintenance.*

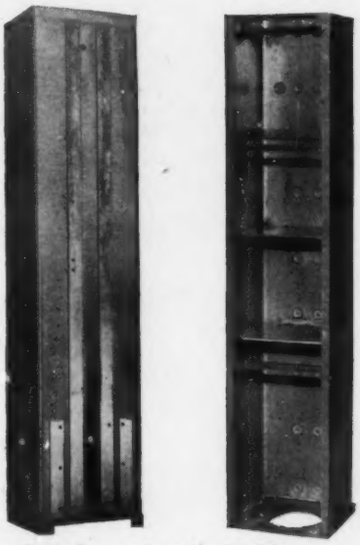
Now possible to include foot control integral with welded frame. *More compact.*



Former Haskins tapping machine.



Machine with welded frame.



Left: Front view of welded frame. Right: Rear view.

ADVICE FROM SHOP MANAGER:

"WELD IT FOR LOW COST!"

RESULTS:

Former frame weighed 177 lbs. Welded frame weighs 104 lbs. ... *41% lighter.*

One standard frame for all 5 models permits *interchangeability of jigs and less inventory.*

Holes formerly drilled; now are punched. Welded steel eliminates 80% of milling operations. *Saves 50% of all machining man-hours.*

Courtesy: R. G. Haskins Company

How can *you* get improvements like this with welded design, *quickly?* Call our nearest office for *Lincolneering Service!*

THE LINCOLN ELECTRIC COMPANY
Dept. I-1 Cleveland 1, Ohio

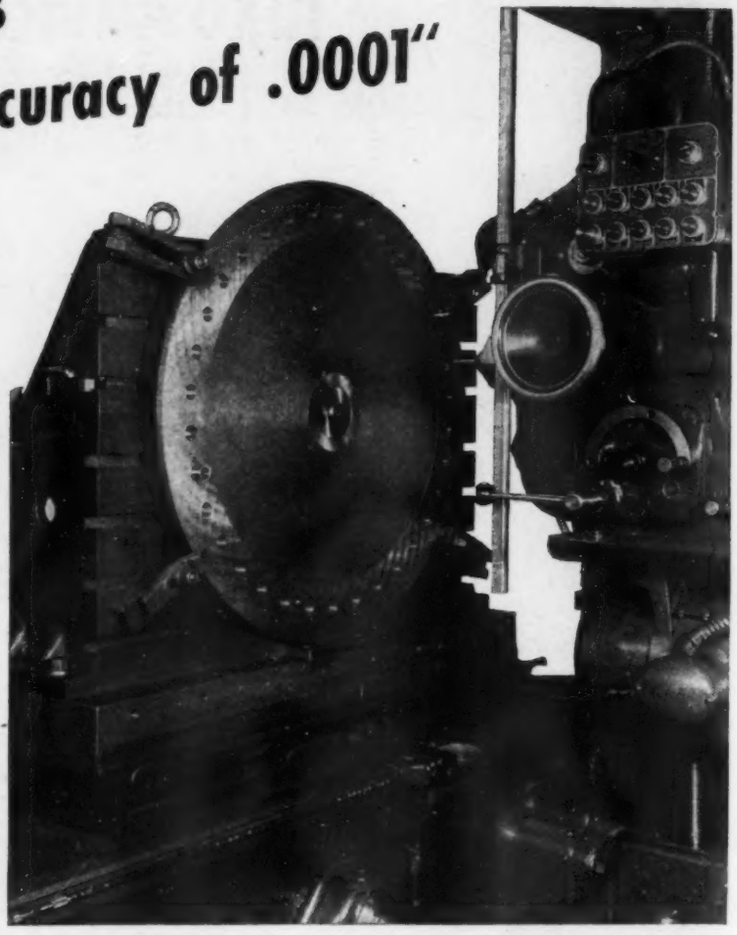
GOOD ADVICE VIA MOVIES

The new Lincoln sound-color movie, "The Prevention and Control of Distortion in Arc Welding" by Walt Disney Productions, explains simply and clearly the causes and cures of distortion. A valuable aid to designers and production men. Available free for showing to groups. Ask for Bul. 709.

America's greatest natural **recourse**

ARC WELDING

34 Index Holes Bored to Spacing Accuracy of .0001" in 10½ Hours!



Here's a typical report on the actual results obtained by one manufacturer using the new Model 3-B DeVlieg JIGMIL on a precision boring operation . . .

Part machined was a large index plate . . . 35" in diameter, 1¾" thick . . . of Mehanite casting. Using a Carboloy boring tool, 34, 1¼" index holes were bored to spacing accuracy of .0001" and shoulder depth of 1½" was held to .0002"! Total floor-to-floor time . . . . including set-up . . . was 10½ hours!

For such outstanding performance, speed and precision on your own boring operations, investigate the unusual accuracy and high productivity of the Model 3-B DeVlieg JIGMIL today!

The world's finest Boring and Milling machine!

Write today for complete descriptive folder.

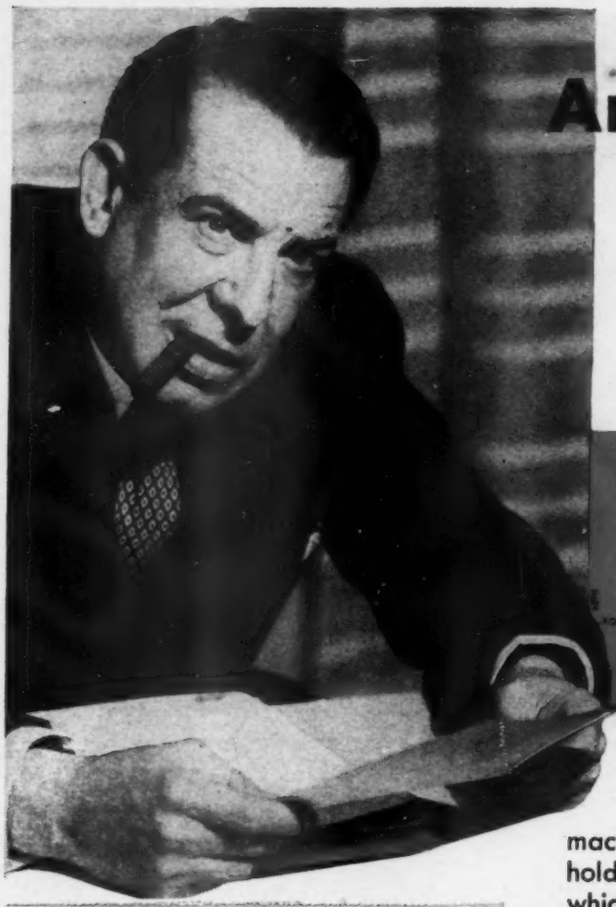
One job well done deserves another

Create More Jobs Faster with a De Vlieg JIGMIL

Here's why users report two to three times the output with greatly increased accuracy as compared to other methods of boring and milling . . .

Centralized push button controls provide fool-proof precision for all functions of the machine. Automatic positioning of spindle from one location to another is controlled to within less than .0001" . . . and feather-touch, pressure controlled slide locks positively assure dependable locking uniformity after positioning.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**



Are Production Costs Bothering YOU?

CUT THEM! WITH TECO CEMENTED CARBIDE

Your first cost-cut with TECO Cemented Carbide comes from increased production per man, per machine. TECO produces more pieces between grinds and holds cutting efficiency longer than other carbides—a fact which you can easily prove.*

Your second cost-cut is in reduced down-time, since TECO-equipped machines run for longer periods and are down less often.

Your third cost-cut is in tool cost. TECO Cemented Carbide is more resistant to wear and breakage, thus gives more grinds per tool and a greater productive life. Fewer tools do a bigger job!

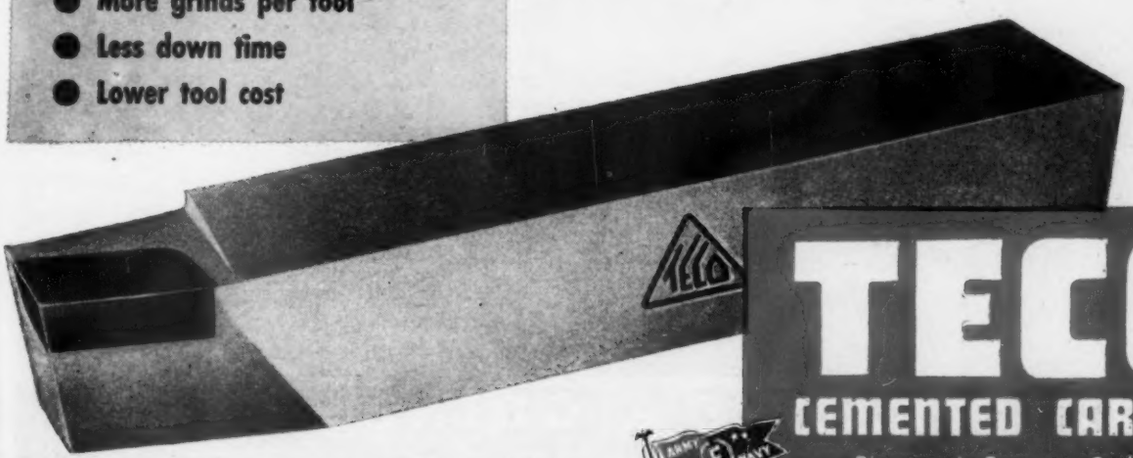
Have one of our tool engineers discuss your needs. Write for catalog and price list.

TUNGSTEN ELECTRIC CORPORATION • 568 39th St., Union City, N. J.

*Prove it this Way!

Tool up a few jobs with TECO Cemented Carbide. Run exactly as with your present tools. Then check the work, pieces between grinds, grinds per tool, total pieces produced. You'll find that you get

- More pieces between grinds
- More grinds per tool
- Less down time
- Lower tool cost

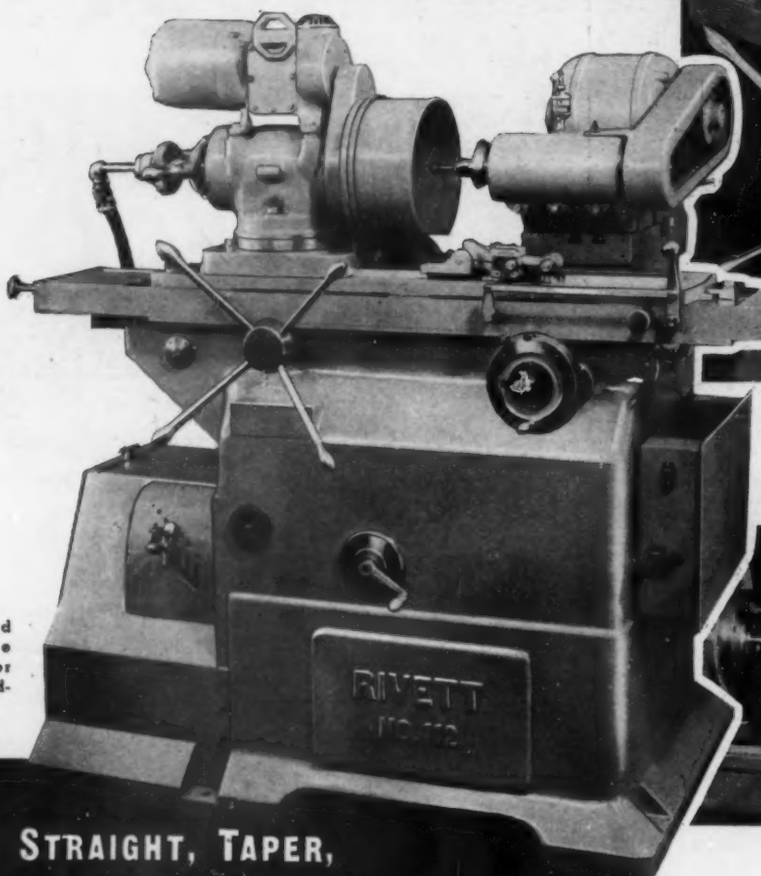


TECO
CEMENTED CARBIDE
Pioneers in Tungsten Carbides for over a Quarter Century

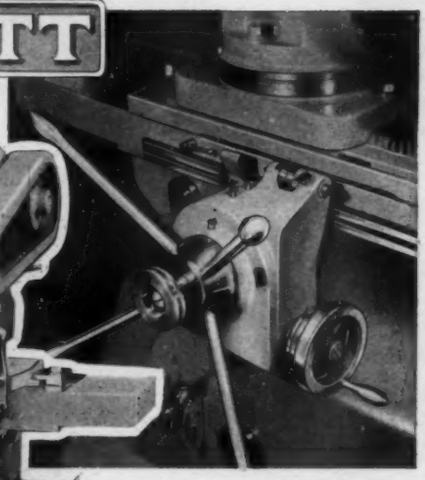
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representatives: Indianapolis, Ind., Chicago, Ill., Detroit, Mich.

A MORE *Versatile* PRECISION GRINDER

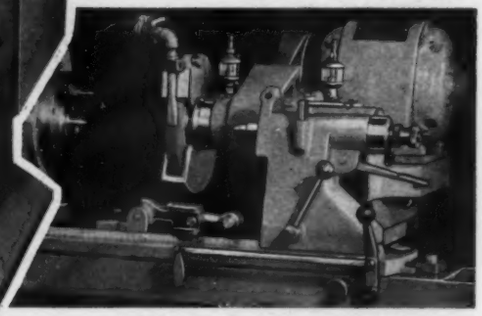
RIVETT



Standard machine equipped for internal grinding.



Fine table feed with micrometer stop for shoulder and face grinding.



Bracket with spindle for external grinding and tail stock for mounting work on centers.

FOR STRAIGHT, TAPER, BEVEL OR STRAIGHT AND BEVEL GRINDING

The Rivett No. 112 Universal Grinder is primarily for tool room work. Internal and external spindles, in combination with many adjustments, make possible a greater variety of precision operations. Extreme simplicity of design assures easy and efficient operation by even the lay machinist.

SPECIFICATIONS

Grinding cap., hole dia.	1/8" to 8"
Grinding cap., outside dia.	up to 8"
Automatic table travel	1/2" to 8"
Table speeds	18 selective
Hand table travel	16"
Swing over table	14"
Workhead swivel	90°
Table swivel	5°
Cross slide swivel	90°
Cross feed graduations	.0005"
Travel of cross slide	3 1/2"
Collet capacity	1"
Step chuck capacity	8"
Jaw chuck capacity	8"
Workhead speeds	
Spindle	150-450 r.p.m.
Dead center	100-300 r.p.m.
Grinding spindle speeds:	
Internal	5000 to 25000 r.p.m.
External	3300 r.p.m.
Automatic Oil Lubrication	
Net weight with motors	3700 lbs.

RIVETT LATHE & GRINDER INC.

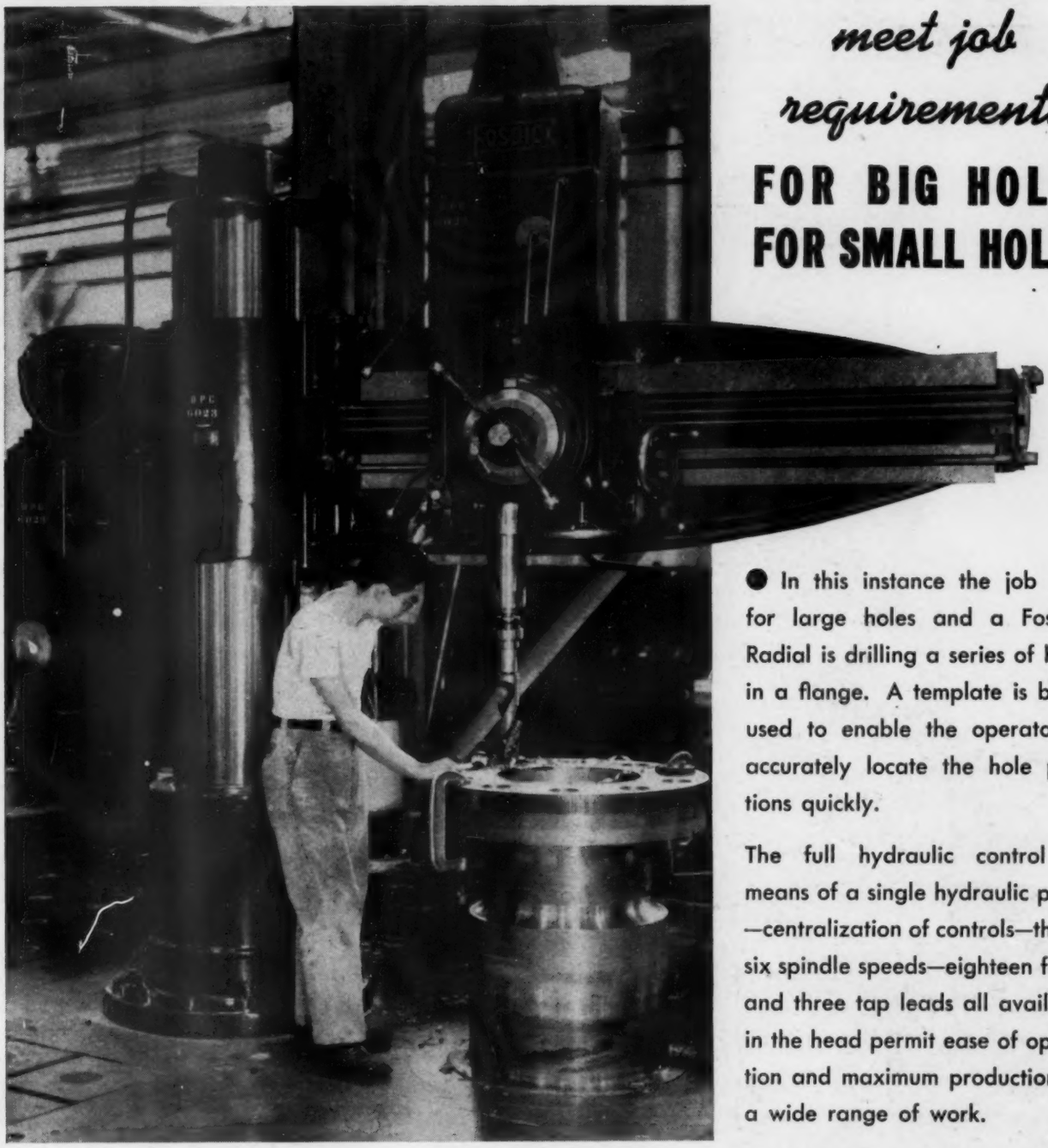
ARMY E NAVY

BRIGHTON, BOSTON, MASS.

FOSDICK RADIALS

meet job requirements

FOR BIG HOLES
FOR SMALL HOLES



● In this instance the job calls for large holes and a Fosdick Radial is drilling a series of holes in a flange. A template is being used to enable the operator to accurately locate the hole positions quickly.

The full hydraulic control by means of a single hydraulic pump —centralization of controls—thirty-six spindle speeds—eighteen feeds and three tap leads all available in the head permit ease of operation and maximum production on a wide range of work.

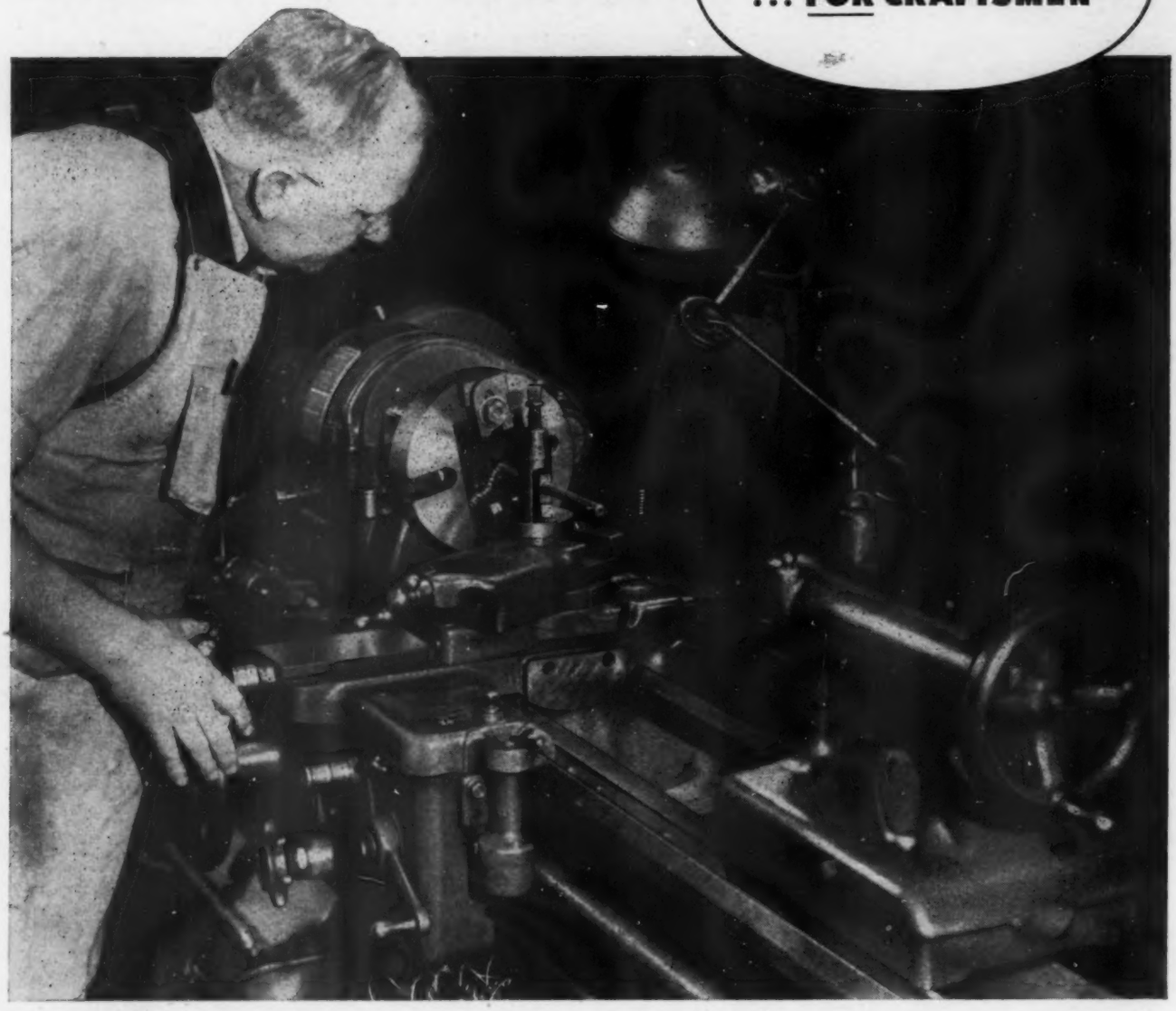
If your work calls for a Radial put it on a Fosdick for speed—for accuracy—for economy.

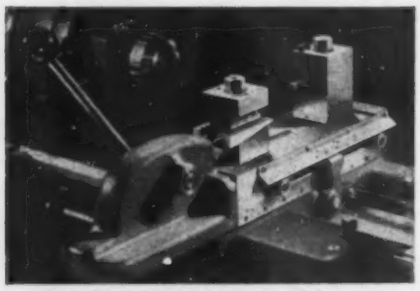
FOR COMPLETE mechanical details write for Fosdick Radial Drill Bulletin R. D. A. or consult a Fosdick representative on your radial drill problem.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

South Bend Lathes

BUILT BY CRAFTSMEN ... FOR CRAFTSMEN





BROADEN THE SCOPE OF YOUR LATHES

South Bend Attachments and Accessories simplify the tooling of South Bend Lathes for special types of precision work. Write for Catalog 77.

Iron, steel, brass, bronze, and other vitally important materials used in the construction of South Bend Precision Lathes, are carefully selected for grade and quality. Just as important as these quality materials is the readily recognizable craftsmanship which goes into the making of these versatile machine tools. It is this craftsmanship—the keen perception, care, skill, and precision workmanship of men who take pride in their craft—which helps to make South Bend Lathes the fine, dependable, precision tools that they are.

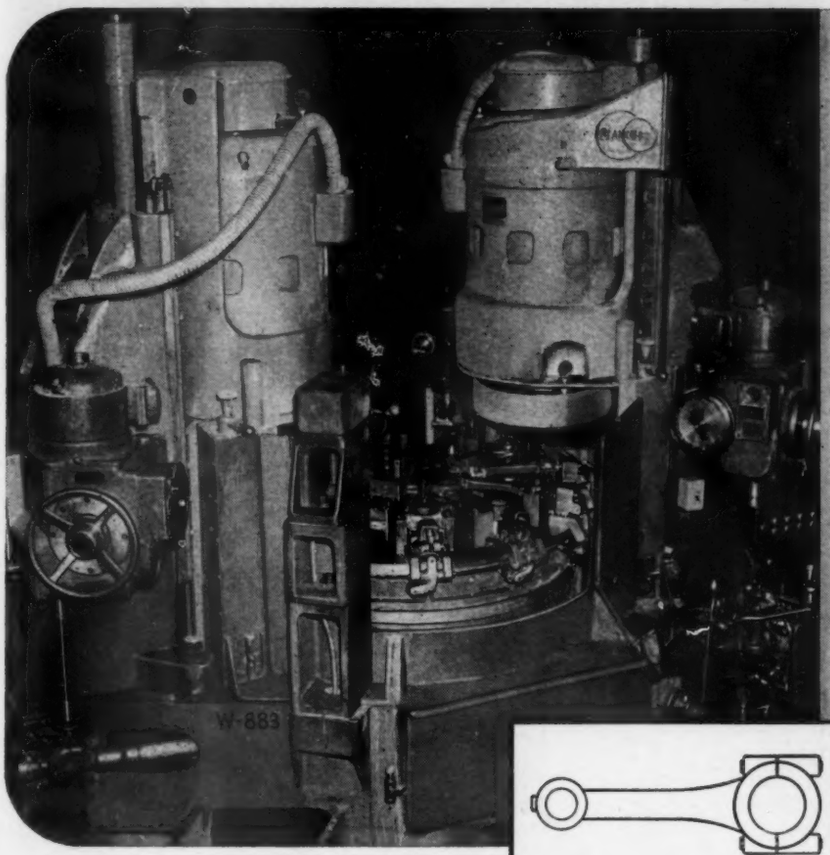
Made by craftsmen for the use of craftsmen in whose work fine precision is essential, South Bend Precision Lathes will give you complete satisfaction in all your toolroom and production needs. Write today for Catalog 100-D which illustrates in full color and describes all sizes of South Bend Precision Engine, Toolroom, and Turret Lathes.

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

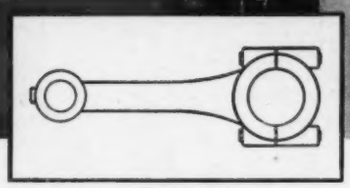
LATHE BUILDERS SINCE 1906

"Put it on the Blanchard"



GET THESE *Advantages*

Production ✓
Adaptability ✓
Fixture Saving
Operation Saving ✓
Material Saving
Close Limits ✓
Fine Finish
Flatness ✓



Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

These steel forged connecting rods are ground both sides of both ends on a No. 16-A Dual Blanchard Automatic Surface Grinder with a 43" chuck. The special 12-station fixture was designed and built by Blanchard.

From each side of both ends .012" of stock is removed to limits of ± .0005".

The production is at the rate of 400 surfaces per hour, or 100 completed pieces.

The 16-A Dual Blanchard is equipped with two grinding wheels, each with automatic size control, thus insuring the finished dimension.

Put it on the Blanchard for more economical production.

BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

DEVELOPMENT?

ENGINEERING

SERVICE?

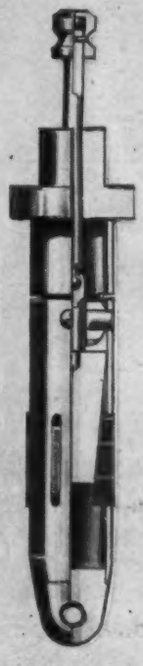
PRODUCTION?

Isn't it Distribution?

● All of the intended benefits and usefulness of your product—the brain-beating which conceived and fashioned it; the sweat, toil and risk-taking which produced it—depend upon your determination to put improved quality products into the hands of the most users at the lowest possible price. The ultimate success of your enterprise depends on balanced, economical distribution of its results.

Production economy is usually considered a necessary first step in distribution economy; and, in view of the recently increased rate of technological development, it is logical first to explore all possibilities for maintaining low unit costs of production. With probable higher labor costs ahead of us, it is evident that we can attain low production cost per man-hour only through improved machinery, improved methods of processing and improved methods of distribution.

Micromatic Microhoning—the newest desirable, high production method of final precision machining of cylinder bores—has already made substantial



improvements in quality, and cost reductions in a wide range of products in the automotive, aircraft, diesel, refrigeration, compressor, anti-friction bearings and other manufacturing industries. It can remove a large amount of metal without damaging the subsurface structure; it has eliminated one or two steps in the final processing of cylinder bores in many parts.

In this processing, a tool carrying several abrasive sticks is revolved while also being stroked in a simple or compound reciprocating motion. Applicable to internal and some external cylindrical surfaces, it removes metal at rates ranging up to .008 to .010 on diameter per minute; and in quantity up to .070 to .080 on diameter, or volume as high as 75 cubic inches per hour. It corrects errors of previous processing and generates true roundness, bore wall and axial straightness in a majority of applications within tolerances ranging from .0001 to .0005. It is available with automatic size control which holds size uniformity within .0001 to .0003 in high production.

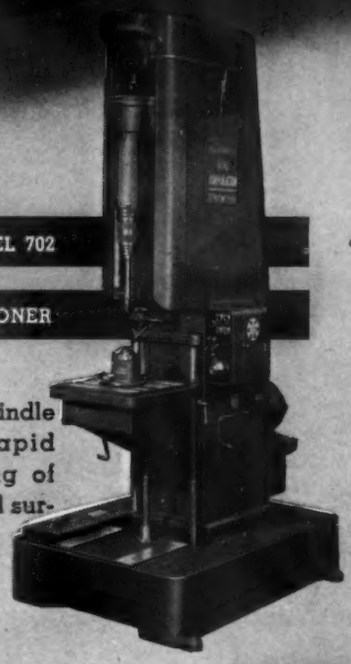
MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

FUNDAMENTAL TO LOWER COST, VOLUME PRODUCTION ARE MODERN TOOLS SUCH AS

MICROMATIC HONING MACHINES

Industry after the war will need modern production tools as much as it will need modern distribution methods. Micromatic Honing Machines have developed rapidly to ultra-modern, high speed tools for final precision machining.



MICROMATIC MODEL 702

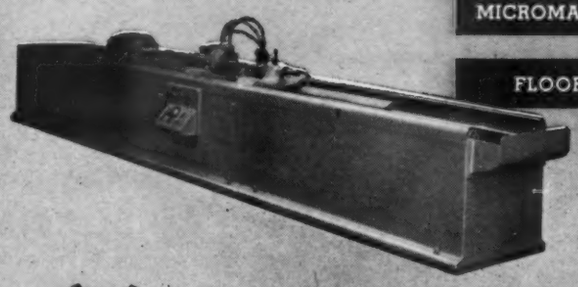
VERTICAL HYDROHONER

Standard single spindle type—built for rapid production honing of bores or cylindrical surfaces up to 2" in diameter.

MICROMATIC MODEL 705 MULTIPLE

SPINDLE VERTICAL HYDROHONER

with built-in automatic Microsize Control. For internal honing. Rotary indexing work table provides high production. Usually recommended for maximum stock removal ranging from .0005" to .0015" on hardened parts—.001" to .010" on soft or medium hard. Bores from ¼" to 2" diameter. Microsize control gauges work automatically. Work is held uniformly within tolerances of .0003". Honing cycle is automatically stopped when correct size is reached.



MICROMATIC HORIZONTAL

FLOOR TYPE HYDROHONER

for internal or external honing. Tool operates either under hydraulic or manual control. Tools available to generate either crosshatch or co-directional finish patterns. Full floating tool action. Stock removal .0015" to .002"—precision generated size limits .0003". Corrects error for taper to within .0001" limit. Size of work accommodated 1" up.

MICRO MATIC

because they can be depended on for
ECONOMY, EFFICIENCY *and* SPEED

All the essential performance qualities demanded in small tools today are met in UNION TOOLS.

Faster cutting, longer life between grinds, accuracy and all-round better performance of these tools are matters of common recognition in plants busy on war work where small tools are subjected to the most exacting service conditions.

You, too, can depend on UNION TOOLS for your requirements. Try them once and you'll use them regularly.

THE UNION LINE

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

●

UNION TWIST DRILL COMPANY, ATHOL, MASS.

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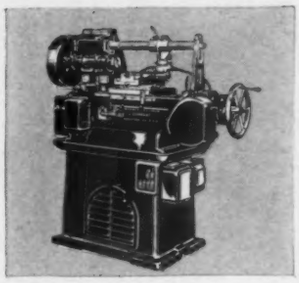
UNION

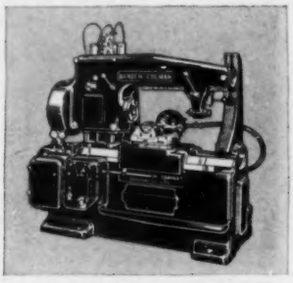
Accurate and Dependable Machine Tools, Cutting Tools...for Precision and Production Work



No. 3 Standard Hobbing Machine — Capacity: 5" dia. x 7" face. 12 Pitch and finer. Built also in Precision Type.

TYPE A Hobbing Machine — a rigid, accurate machine for general purpose or production hobbing. Capacity: 12" dia. x 12" face. 4 Pitch and finer.

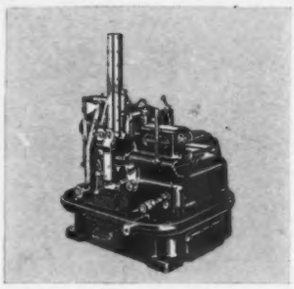
TYPE T Taper Spline Hobbing Machine — May be used also on general hobbing work within its capacity. Spur and spiral gears, straight and involute splines, etc., may be hobbed.



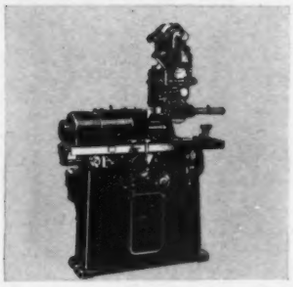
TYPE D Hobbing Machine — a heavy duty high production machine powered hydraulically. Capacity: 14" dia. x 14" face. 3 Pitch and finer.

BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS



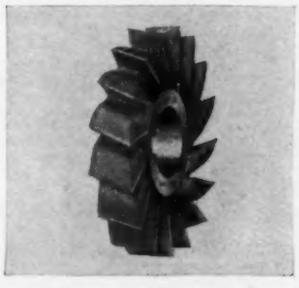
TYPE S Automatic Hobbing Machine — For production of small precision gears up to 1" dia. x ½" face and 200 D.P.



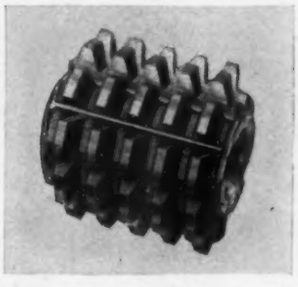
No. 3 Automatic Hob Sharpening Machine for hobs and formed cutters. Capacity up to 4" dia. x 4" face.

No. 4 Automatic Hob Sharpening Machine for hobs and formed cutters. Capacity up to 12" dia. x 12" face.

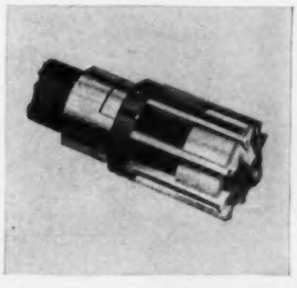
COMBINATION Sharpening Machine — Sharpens hobs, cutters and reamers; straight gashed up to 24" stroke; or maximum 30° helix with 8" stroke.



MILLING CUTTERS — "Paraform" Design; Formed, Standard and Special.



HOBS — Ground and Unground, Standard and Special.



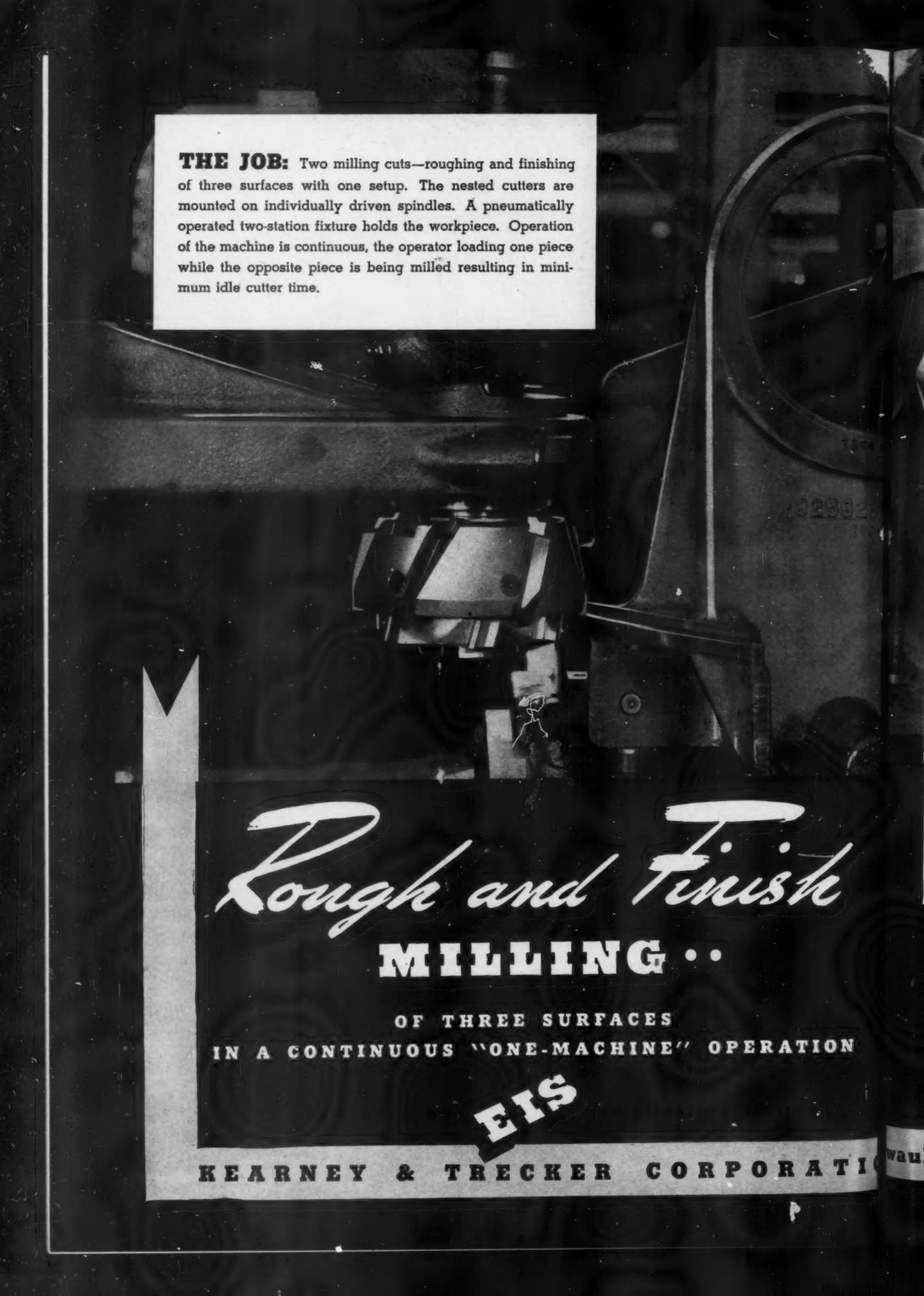
REAMERS — Fluted, Inserted Blade, and "Pinwedge" Expansible Reamers.

For good advice on the application of Hobbing Machines and Small Cutting Tools—or regarding the design of special units to meet individual production requirements—use Barber-Colman Engineering Service. For more than 35 years this specialized experience has helped manufacturers produce products faster, better, and at lower cost.

BARBER-COLMAN COMPANY

LITERATURE DESCRIBING ANY OF OUR PRODUCTS IN DETAIL WILL BE SENT PROMPTLY ON REQUEST.

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.



THE JOB: Two milling cuts—roughing and finishing of three surfaces with one setup. The nested cutters are mounted on individually driven spindles. A pneumatically operated two-station fixture holds the workpiece. Operation of the machine is continuous, the operator loading one piece while the opposite piece is being milled resulting in minimum idle cutter time.

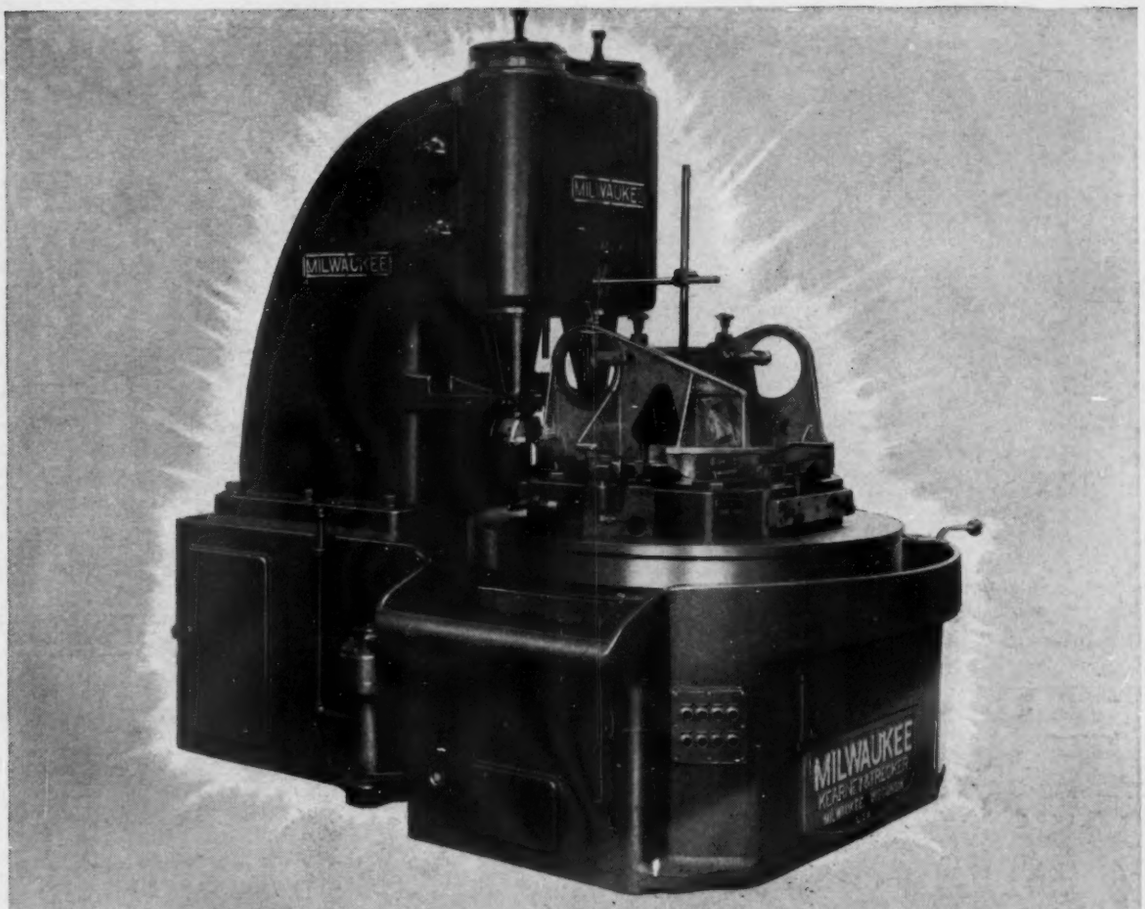
Rough and Finish

MILLING ••

OF THREE SURFACES
IN A CONTINUOUS "ONE-MACHINE" OPERATION

EIS

KEARNEY & TRECKER CORPORATI



THE MACHINE: Kearney & Trecker Vertical Spindle Rotary Table Milling Machine — expressly designed for this mass production operation.

The two-spindle upright on this machine is mounted on sliding ways for lateral adjustment. Each vertical spindle is driven by a 5 hp motor and is quill-mounted to facilitate cutter location. A 3 hp motor drives the 48-inch rotary table. Rate of table movement is controlled by trip dogs in the T-slot on the table periphery, providing both feed and rapid traverse movement at any setting.

The specially designed Vertical Spindle Rotary Table Milling Machine is another example of many special machine tool problems solved by the Engineering Investigation Service of Kearney & Trecker Corporation.

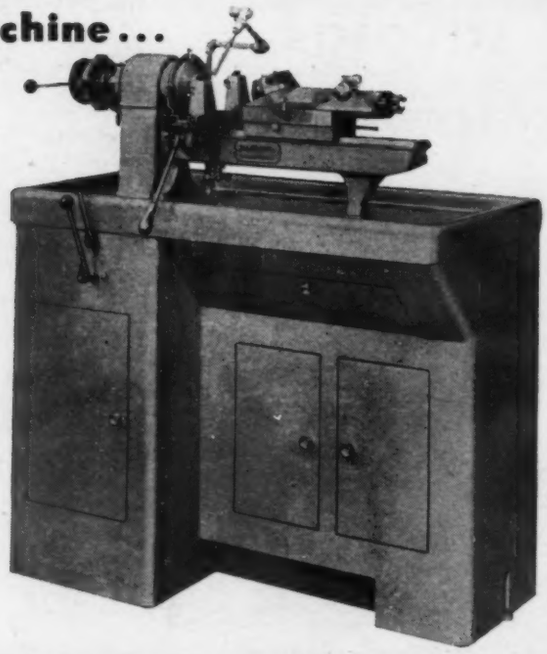
"Engineering Investigation Service" studies your specific production problems and makes recommendations for the necesary equipment. This equipment may be a special machine, a special attachment for a standard machine, a special workholding fixture, or special cutters.

Of vital importance to the user of Kearney & Trecker Engineering Investigation Service is the background of 40 years experience of the Kearney & Trecker organization in the designing and building of precision, high-speed production machine tools.

waukee 14, Wisconsin

ACCURACY

the machine...



the jobs...

the results...

Wade Hand Screw Machines are used on both first and second operations in producing these parts. The stock is oxygen-free copper bar, and the thin wall sections are turned to a feather edge — .002" *thick!* The parts are so accurate and so delicate that they cannot be touched by the operator during production.

Such accuracy and finish again prove our claims on Wade rigidity, because it takes the finest engineering and construction to get results like this. Wade is at your service to show how similar results can be obtained on your precision production parts. Call on them.

Wade

The Wade Tool Company
53 River St., Waltham 59, Mass.

Their savings mean lower operating costs

NEWTON HYDRAULIC FEED COLD SAW MACHINES

The new Newton Cold Saw Machine Bulletin No. 537 is now ready. Write for your copy—today.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL TOOLS

NEWTON Hydraulic Cold Saw Machines are built in a range of designs of proved adaptability to handling all types of work in either ferrous or non-ferrous metals. Built in sizes to accommodate blades from 32″ to 120″ diameter.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

Now . . . 6 Demonstration Rooms Pioneered for Your Use . . .

- **BOSTON**
- **CHICAGO**
- **CLEVELAND**
- **DETROIT**
- **ST. LOUIS**
- **TROY**

Others to follow.

You are invited to try out *right on your own products* the newest Coated Abrasive methods and machines for faster, better grinding and finishing. In these well-equipped rooms you will find, among others, the following standard machines:

Backstands with abrasive belts running over resilient contact wheels which prove your old set-up wheels completely uneconomical.

Wet-belt Grinders equipped with waterproof abrasive belts; no warping or discoloration.

Swing-Frame belt grinders that so staunchly handled the really big jobs of war production.

High-speed portable tools that mount abrasive gadgets—slotted discs, Spirapoints, Spirabands, etc., for recesses hard to reach.

Tiny belt machines for many a finishing and deburring operation; very versatile and economical.

Portable disc grinders for welds, rough edges, metal clean-up, and other tough jobs.

All these, plus fine conference rooms where you can sit around a big table, examine and discuss the latest abrasive specialties and talk over your grinding and finishing problems with our Product Engineers. Make an appointment soon with our nearest Branch.

Maximum CUT — Minimum COST

BEHR-MANNING · TROY, N. Y.

(DIVISION OF NORTON COMPANY)

QUALITY COATED ABRASIVES SINCE 1872

FOR MAXIMUM OUTPUT
Collets to Cams—
Fingers to Forming Tools—
there's a name to remember . . .
—BROWN & SHARPE—
The designs of Brown & Sharpe Screw Machine Tools and Equipment — the features that provide superior performance — their capacity to stand up, their accuracy and the steels selected for them combine to match today's production's needs.
When you need equipment for your screw machines specify screw machine tools, fingers, collets and cam blanks made by Brown & Sharpe. It will help you get the maximum output you expect from your screw machines. Catalog sent on request.
. . . . . We urge buying through the Distributor
For Maximum Output—Use Brown & Sharpe Screw Machine Tools on Brown & Sharpe Screw Machines
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BROWN & SHARPE MFG. CO.
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J. E.
VERTICAL
BROWN & SHARPE

Snyder "Special" DOES A 3-OPERATION JOB ON ALUMINUM ALLOY PISTONS

Typical of many machines designed and built by Snyder for performing one or several operations in processing pistons is this "special" two-spindle automatic for counterboring, facing and centering aluminum alloy pistons.

The machine is a double-station set-up; each spindle is powered independently of the other and can be loaded and started separately if necessary. There are two slides provided with cutting tools, one set for roughing and one set for finishing.

The part is positioned and secured on a vertical stub spindle by means of a pin chuck. The work cycle consists of loading the part and pressing the clamp button which automatically positions and secures the part on the arbor through hydraulic action. When clamping is completed the spindle is started and the tools enter the work, cut to the required depth and automatically withdraw.

The accuracy of the cut and the conformity of the finish to specifications are maintained through the use of carbide tools. Electrical controls permit the machine to be operated successfully by average help.

Machine base and column are welded steel and the base houses spindle drive motors and clamping mechanism. The hydraulic power unit is mounted to the left of the machine. Coolant tank and tray are at the right hand side.

Snyder "specials" are designed and built especially for the accomplishment of accuracy, safety and economy in all types of metal-cutting operations. They permit exact control of those factors which directly affect costs, volume and profits. If you have a metal-cutting problem, we invite your inquiry. *Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*

SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

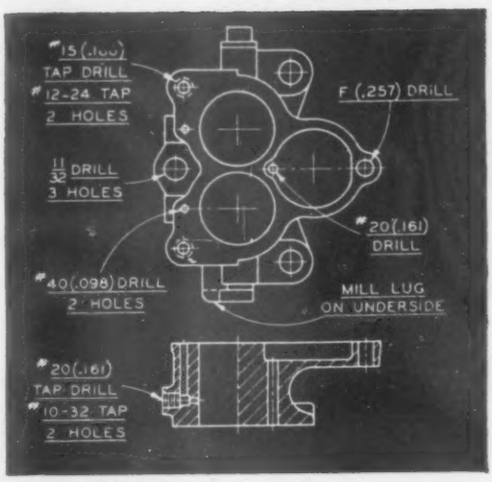
21 Years of Successful Cooperation with Leading American Industries

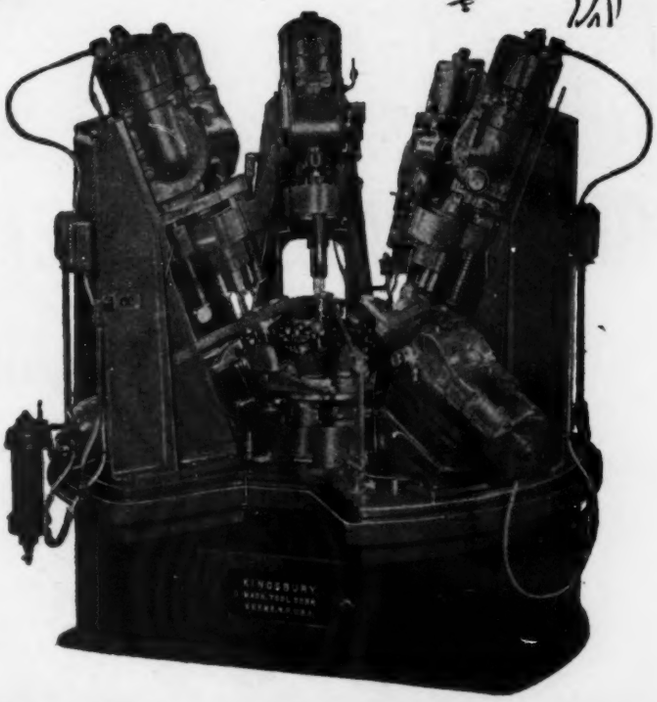
52132

FLEXIMATIC

The THRIFTY *Way*

To Solve Production Problems



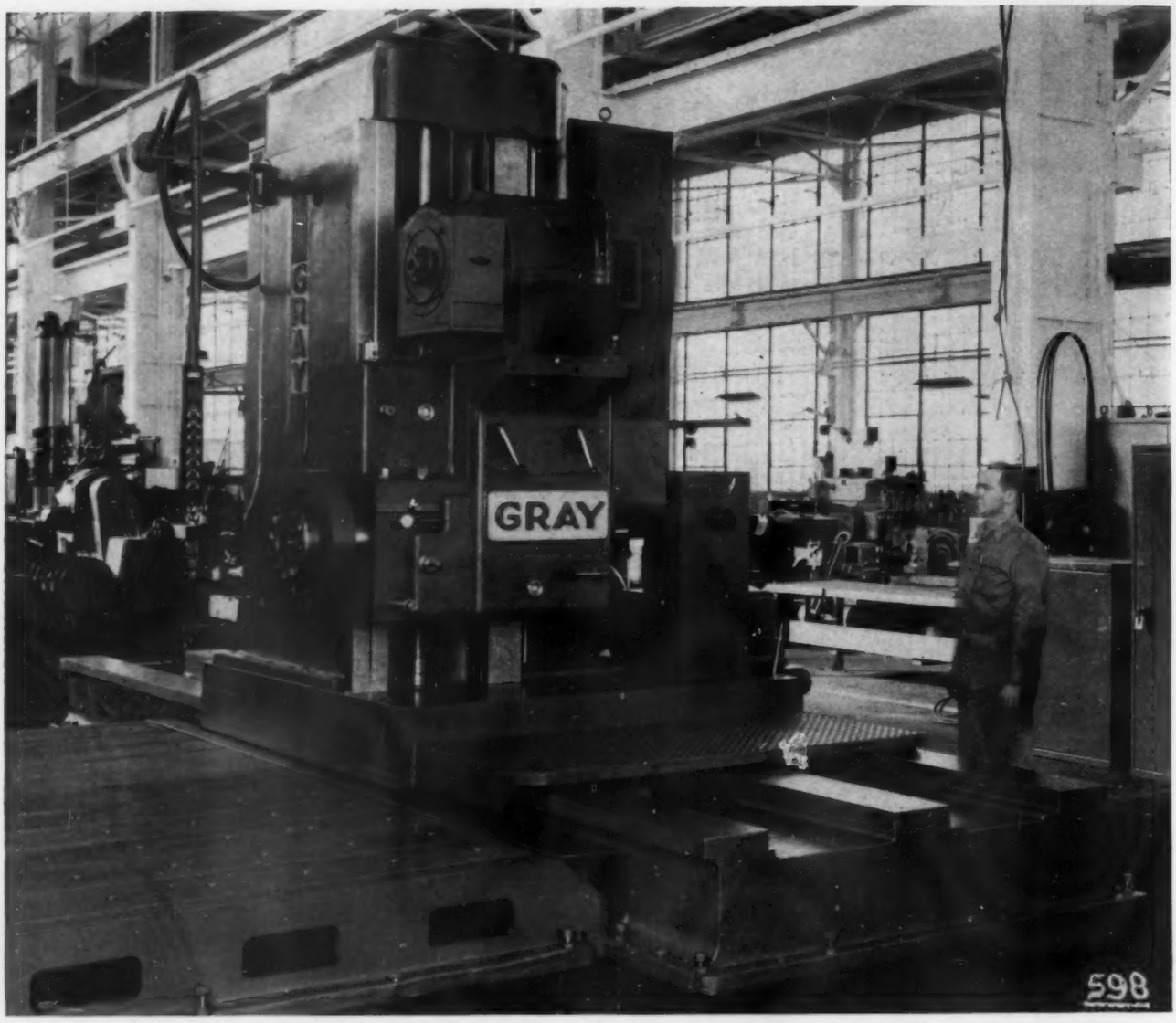


Over a dozen operations on the carburetor throttle valve bodies shown — and Kingsbury FLEXIMATICS perform the entire job in a single chucking of the work! An example of the thrifty way to solve multiple-operation production problems.

FLEXIMATICS are built up of standard Units, set up on a standard base around an automatically indexing work-holding turret. This unit system of construction keeps first costs low—out of the "special machine" class. And in addition, FLEXIMATIC Units can be changed, moved around and mounted in any combination on the base to meet the machining requirements of many different parts. That is why we say that **flexible automatic** FLEXIMATICS are the THRIFTY way to solve production problems.

KINGSBURY MACHINE TOOL CORPORATION

KEENE, NEW HAMPSHIRE, U.S.A.



GRAY TRAVELING HEAD MILLING MACHINE

especially adapted for high power milling of steel with carbide cutters

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SOLD IN LATIN AMERICA BY MACHINE AFFILIATES.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
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MILLING PLANERS
•
PLANER TYPE MILLING MACHINES
•
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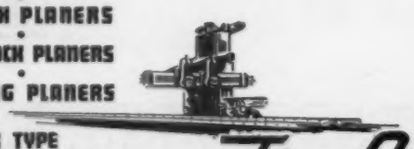

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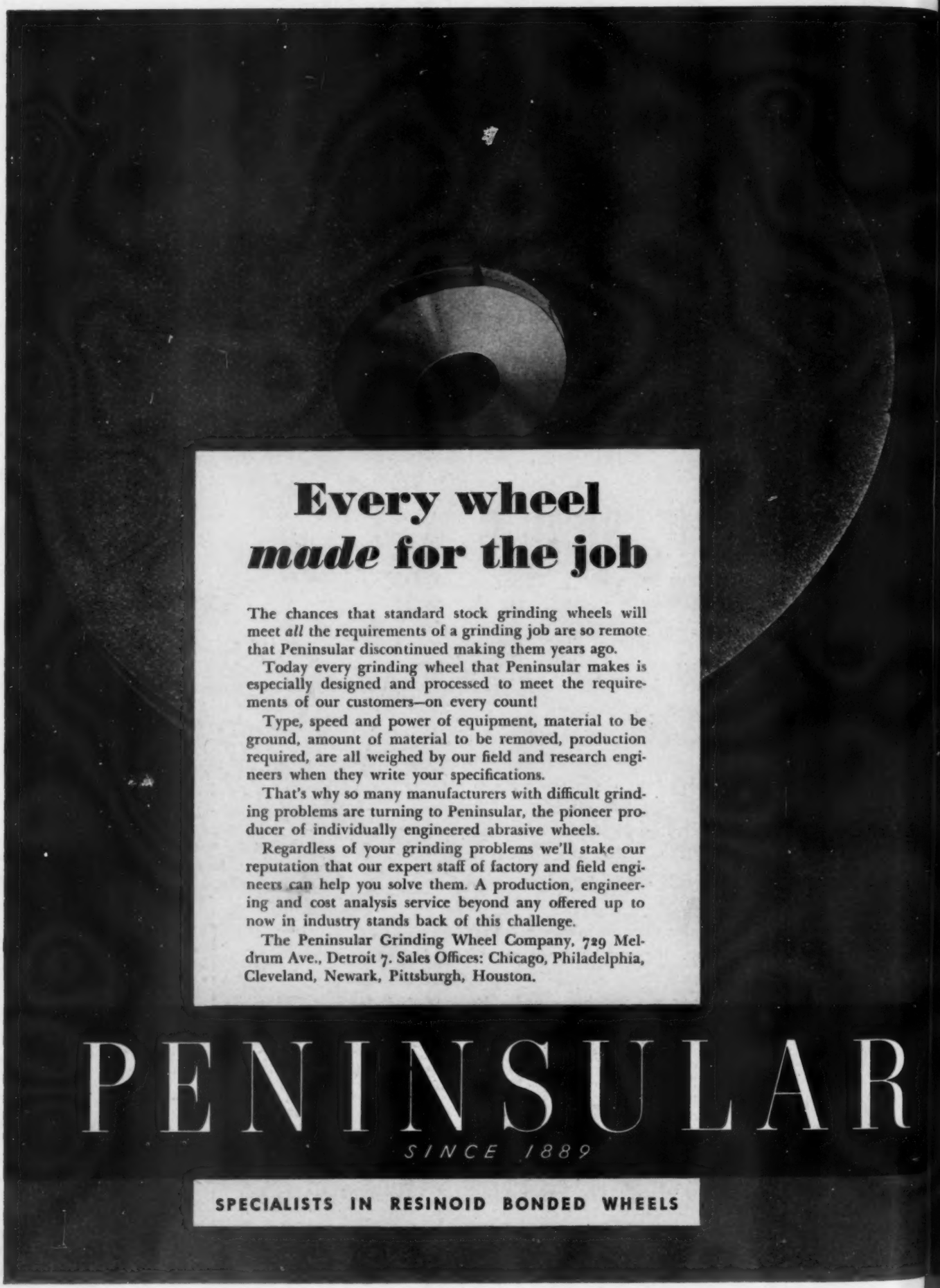

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Today every grinding wheel that Peninsular makes is especially designed and processed to meet the requirements of our customers—on every count!

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That's why so many manufacturers with difficult grinding problems are turning to Peninsular, the pioneer producer of individually engineered abrasive wheels.

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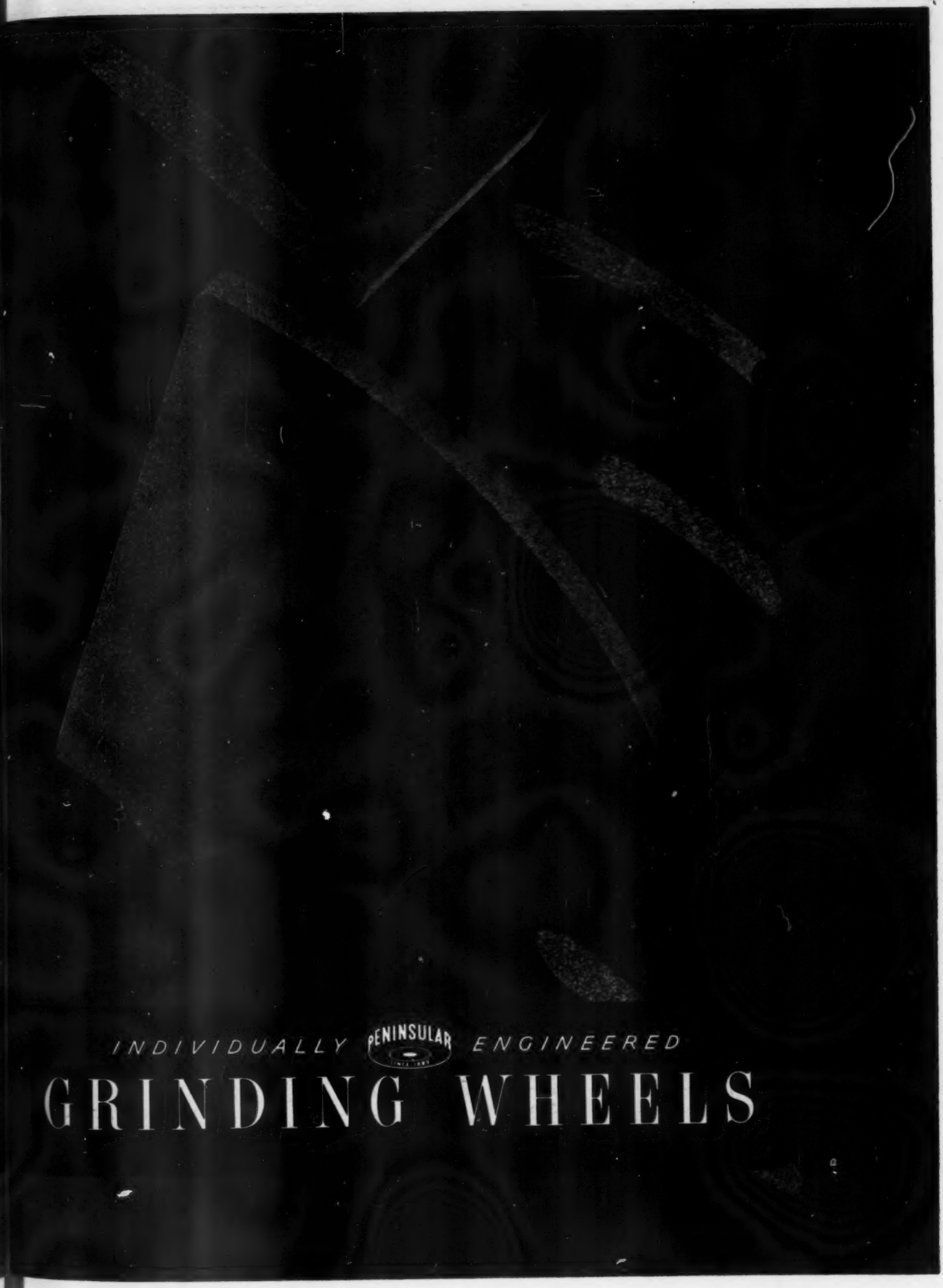
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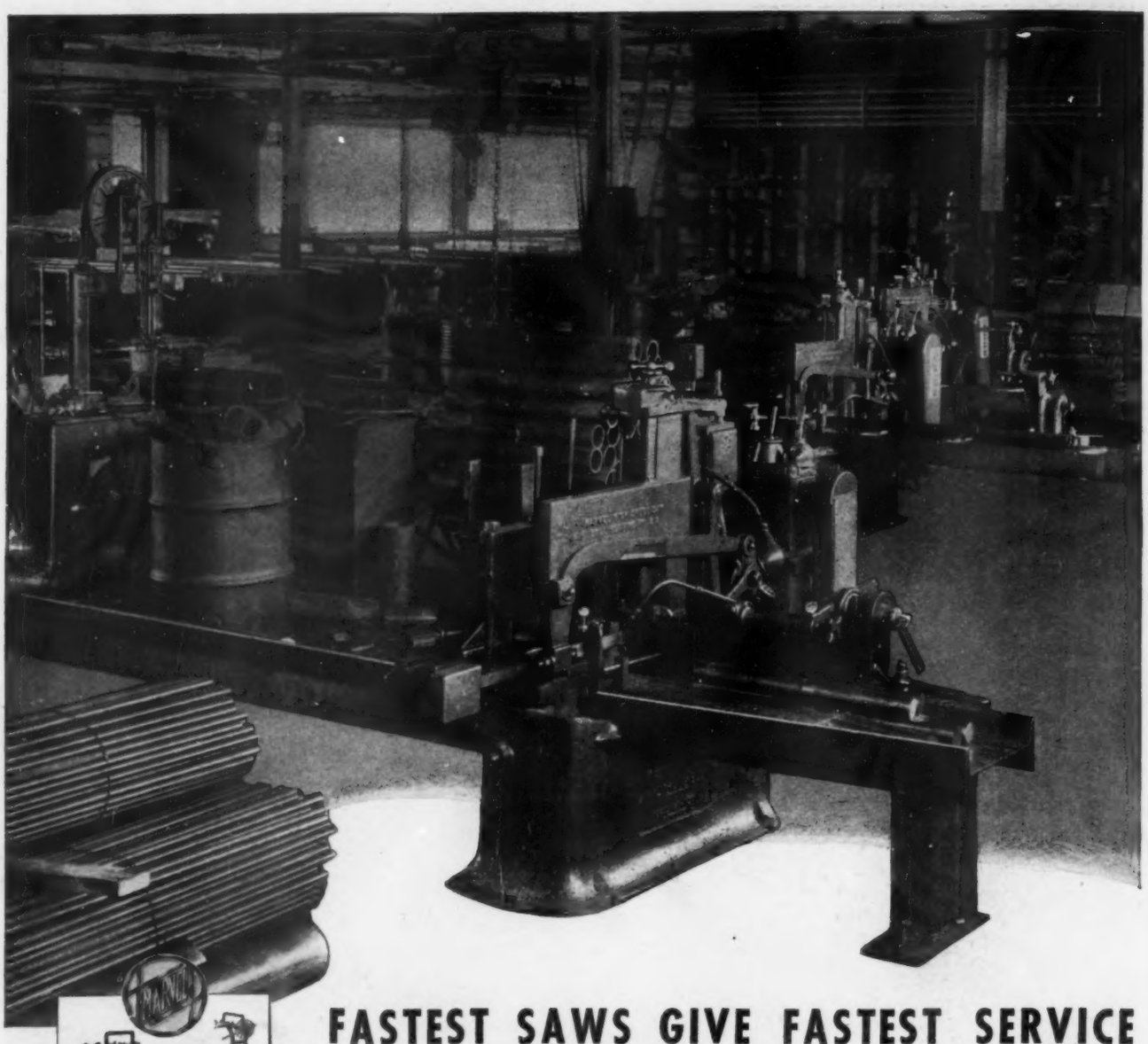

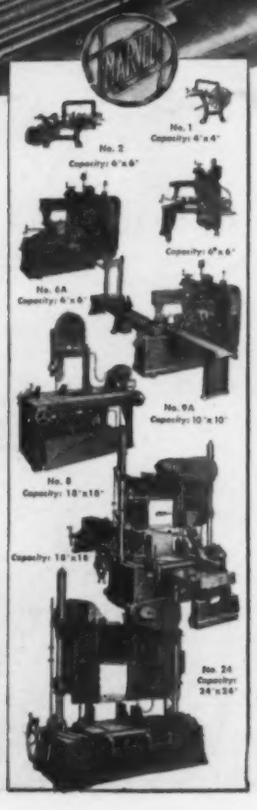

FASTEST SAWS GIVE FASTEST SERVICE

With these four modern MARVEL SAWS, the Hamilton Steel Co. of Cleveland is building a reputation for fast service on orders for accurately cut lengths and pieces. They use a Universal No. 8 MARVEL Metal-cutting Band Saw for the big work (up to 18" x 18"), for angle cuts (at any angle in a 180° radius), for knotching, mitering and roughing to size and shape. For high speed cutting-off from bar stock up to 10" x 10", they have three No. 9A MARVEL Production Saws. These "fastest saws built" are used for cutting-off single pieces, or with their automatic bar-push-ups, for automatically reducing single or nested bars to slices (as gear blanks) or identical lengths, faster than is possible, with equal accuracy by any other method.

With 9 distinct types of MARVEL Metal-cutting Saws; with the positively unbreakable MARVEL High-Speed-Edge Hack Saw Blades; and, with MARVEL Band Saw Blades, the MARVEL System of Metal Sawing has a better way for doing innumerable metal-cutting jobs. If you have a difficult metal sawing problem or just want a saw, MARVEL is your logical source.

For quick reference, see our section in Sweet's File—Mechanical Industries, or write for catalog.

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SIDE FRAMES?
Alcoa has the facilities and know-how for making large, dependable aluminum forgings

Unsprung weight, arch enemy of rails and roadbeds, may lose much of its damaging effect if side frames are made of lightweight Alcoa Aluminum. Forgings of comparable size saw service all during the war.

Designers of rolling stock who are interested in determining what Alcoa Aluminum forgings will do for them are invited to talk with Alcoa engineers. These men, knowing the possibilities of the forging process, are well equipped to advise you.

Consider Alcoa Aluminum forgings for use in all types of equipment where high strength-weight ratios are required. Address inquiries to ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

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ALCOA ALUMINUM

No more scenes like this when you use the *new*

HALLOWELL KEY UNBRAKO KIT

Pocketsized, Versatile, Useful, Rugged, Durable

Think how much easier, how much more convenient to have all your bits assembled in one kit, . . . so small that it will fit in the palm of your hand. It saves space, eliminates carrying around a lot of bulky, heavy wrenches and screw drivers, lessens the chance of misplacing them. The "Hallowell" "Unbrako" Key Kit is a compact, complete screw-driver service. The kit itself is only about 6" long, has an indestructible, hollow, shiny black plastic handle which holds the bits. To use, simply remove the top, select the bit you want, and insert it in the chuck. The swivel chuck enables you to have the direct drive of a straight handle screw driver, or, you can lock it at an angle, or at a right angle position for reaching those "hard-to-get-at" places.

Incidentally, this is a rugged, durable tool. The bits and swivel chuck are made of the finest alloy steel to assure you of long and satisfactory service.

The "Unbrako" Speed Tool Key Kit is made in two sizes:

No. 25: contains seven hex, two Phillips, one slotted screw bit.
No. 50: contains six hex, two Phillips, one slotted screw bit.

If your Distributor does not carry it, send his name to us, along with yours, and you will be taken care of promptly.

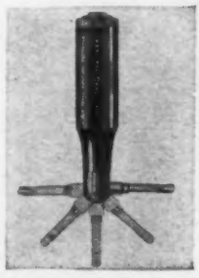

Illustration shows different positions to which swivel chuck permits bit to be swung.

Easily managed, fits comfortably in hand. Bits are placed in hollow plastic handle.

Over 40 Years in Business

STANDARD PRESSED STEEL CO.

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Let's GO Ahead in '46!

Cut Production Milling Costs to a Minimum with Kempsmith STANDARD ATTACHMENTS

Here's an excellent New Year's resolution! Resolve this year to cut production costs to a minimum. War-time profits will soon "hit the toboggan," so steps must be taken to cut costs wherever possible. Start in your production milling department by utilizing Kempsmith Standard Attachments in place of expensive "cost-upping", single purpose machines.

It's really surprising, the great variety of milling operations that can be handled by Kempsmith Standard Attachments mounted on a standard milling machine. The same high degree of rigidity and precision characteristic of Kempsmith machines for more than 56 years is embodied in these sturdy standard attachments. Thousands are serving industry, every day, performing difficult toolroom and production milling jobs . . . and they can do the same for YOU, in '46. Mail coupon for literature.

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THIS valve tappet roller pin is perhaps one of the simplest-appearing parts produced at Allied Products, yet it typifies the production skill and ingenuity of the entire Allied organization.

Special machining methods developed by Allied Products to form the radii on the two ends have made it possible to produce millions of these pins much more rapidly than by operations previously employed. Closer tolerances have been held. Because of lower manufacturing costs, the customer has realized appreciable savings.

In each of the four large, modern Allied plants new and better methods of manufacture are constantly being developed and put in use. The resulting benefits of faster production, higher quality and lower costs are reflected in parts now being produced for mass production industries. If you are not entirely familiar with our unusual facilities, let us send you our new brochure.

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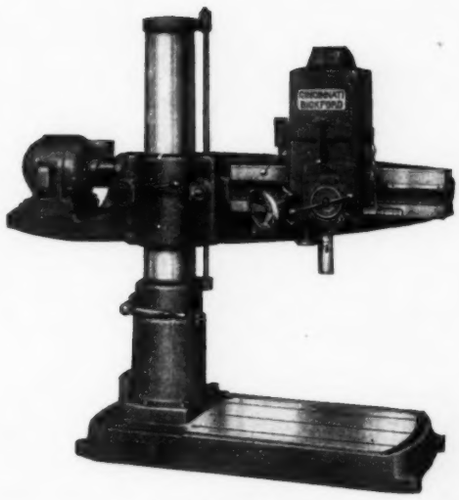
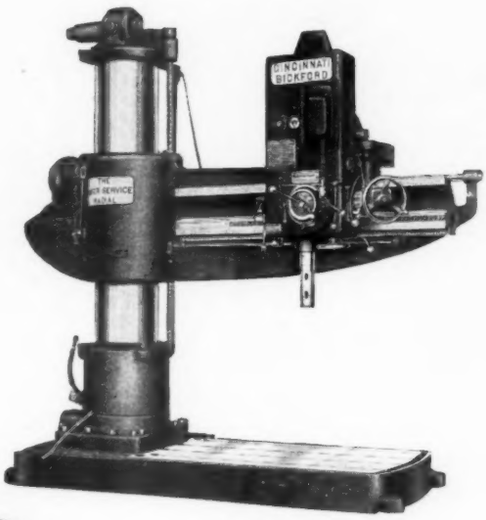
Modern in every way, these tools bring every convenience to the operator, and are the result of years of development and experience, and the application of advanced engineering thought. Accuracy, ample power, ease of control and profitable performance are found in every machine in the line.



HIGH-SPEED SUPER-SERVICE RADIAL

Central controls, extreme ease of handling —highly productive, nine spindle speeds up to 3500 R.P.M.; 3' and 4' arm; 9" column.

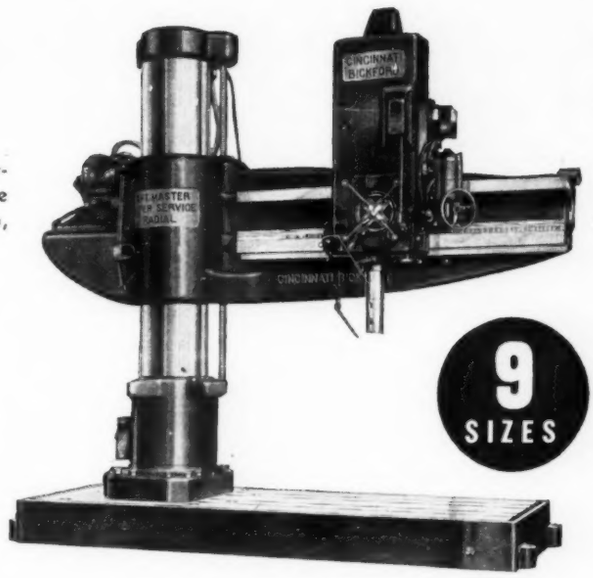
2 SIZES



13 SIZES

SUPER-SERVICE RADIAL

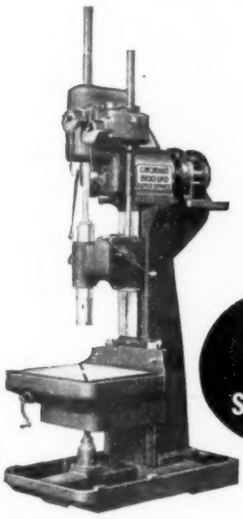
Productive, economical, accurate in performance—with ample power and great ease of control. Sizes: 3' arm, 11" column, to 8' arm, 19" column.



9 SIZES

MASTER SUPER-SERVICE RADIALS

For the heaviest jobs. Centralized controls. Forty horsepower, constant speed driving motor. Accurate and easy to handle. Sizes: 22" column, 7' to 10' arm; 26" column; 8' to 12' arm.



3 SIZES

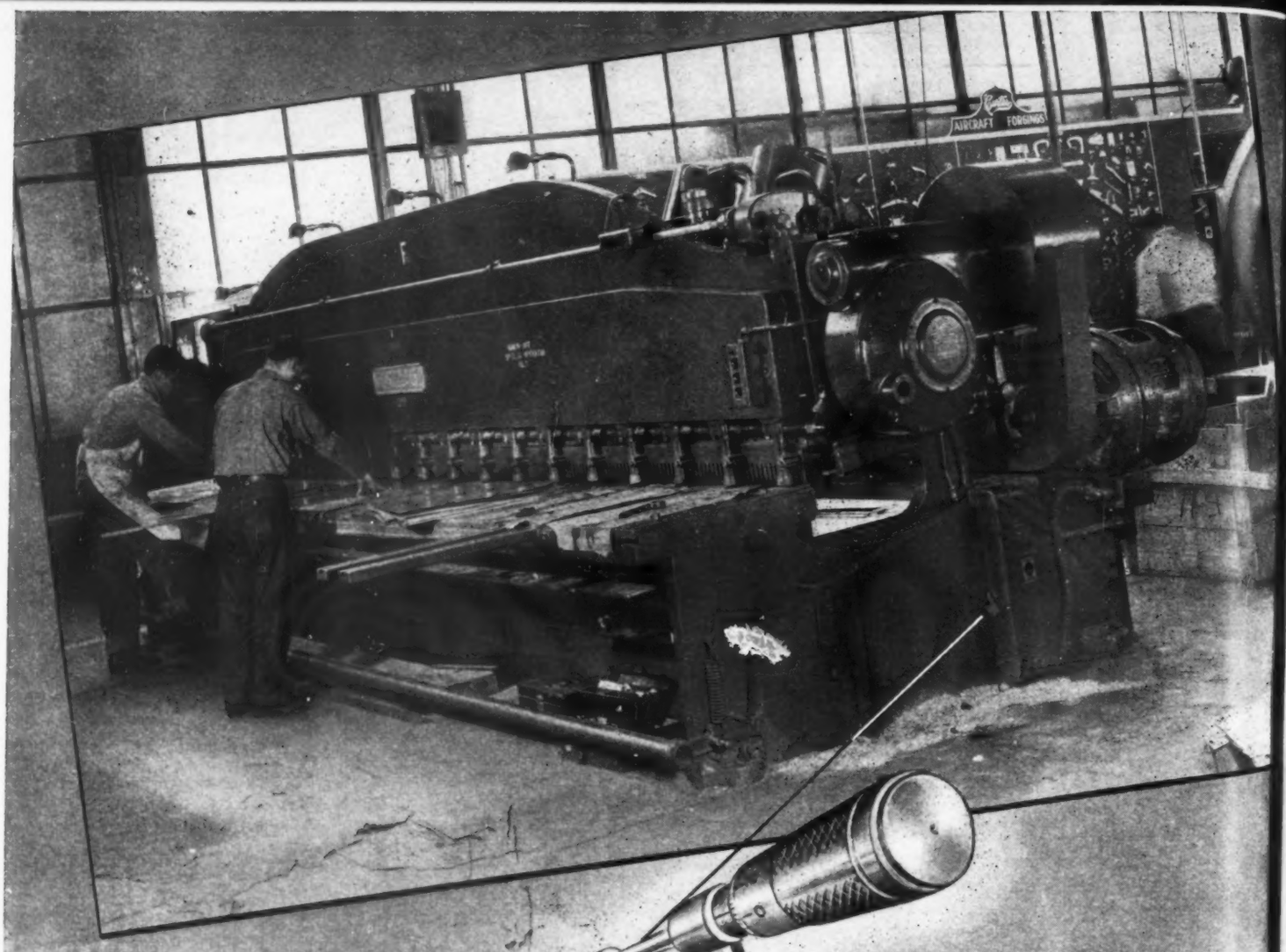
SUPER-SERVICE UPRIGHTS

Sturdy, simple and convenient controls for wide ranges of feeds and speeds furnished in both round and box type columns. Sizes: 21", 24" and 28".

RADIAL AND UPRIGHT SUPER CB SERVICE DRILLING MACHINES

Write for detailed Bulletin R-24A. See our condensed catalog in Sweet's File

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.



Shear to THOUSANDTHS OF AN INCH...

The square blank—the accurate blank—is the profitable blank. The rapid, accurate performance of Cincinnati Shears saves many an hour in the forming and punching operations, and many an hour in the general assembly and fabrication that follow.

Cincinnati Shears pay double dividends in time saved in shearing and in time saved in fabrication.

• *Write for Shear Catalog No. S-3.*

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

The Truth About Our Export Trade

OUR government officials and economists have indulged in some fancy thinking and tall talking about our foreign trade after the war.

More than a year ago they had the British deeply worried for fear we would take away a substantial chunk of their export business.

The British, however, should relax. If what we have seen thus far is a fair sample of our export efforts, they need not doubt their ability to compete successfully with us.

For the truth is that we have fumbled the ball. Meanwhile the alert British have picked it up and are heading for a touchdown.

The British are straining every muscle to secure export orders. The Labor government is working hand-in-glove with Conservative businessmen. Red tape is at a minimum. It is hard to distinguish between a British government official and a British businessman. They are working admirably and skillfully alongside each other in a common cause—expansion of export trade.

We are slow-footed, by contrast. Teamwork is lacking. Instead of encouraging industry to seek foreign orders, Washington agencies are doing their best to drive business into the hands of other countries. Not intentionally, of course, but by their inability to make prompt and clean-cut policy decisions.

For evidence we turn to the French and Belgians. We have lost by default millions of dollars worth of machinery orders because the French and Belgian purchasing missions were given the "runaround." Washington has taken its own sweet time, and still is, rendering imperious decisions. We have given the impression that our official policy is "the customer be damned."

All the blame, however, is not government's. Manufacturers, too, must assume their share.

The fact is that many top executives in our industries are genuinely interested in foreign business only when domestic orders and prospects are at a low point. Today they may be indifferent to export trade because of a big home market. A few months from now, by contrast, they will solemnly declare that foreign business is their lifeblood. They then will ardently court it—for a time.

If we intend doing a serious job of enlarging our foreign markets, the first step is to formulate a firm policy and faithfully carry it out. Government agencies should be organized so as to act quickly on policy matters. They should regard themselves as allies of American businessmen and conduct themselves accordingly.

Manufacturers, for their part, have the obligation of sticking to one policy 365 days a year and not shifting around as convenience and sudden enthusiasms dictate.

Unless we are willing to do that much as a beginning, we should recognize our imaginative and impressive plans for great expansion of our world trade for what they are—merely pipe-dreams.

Burnham Finney

Designed for the job **MORRIS** *Production Equipment*

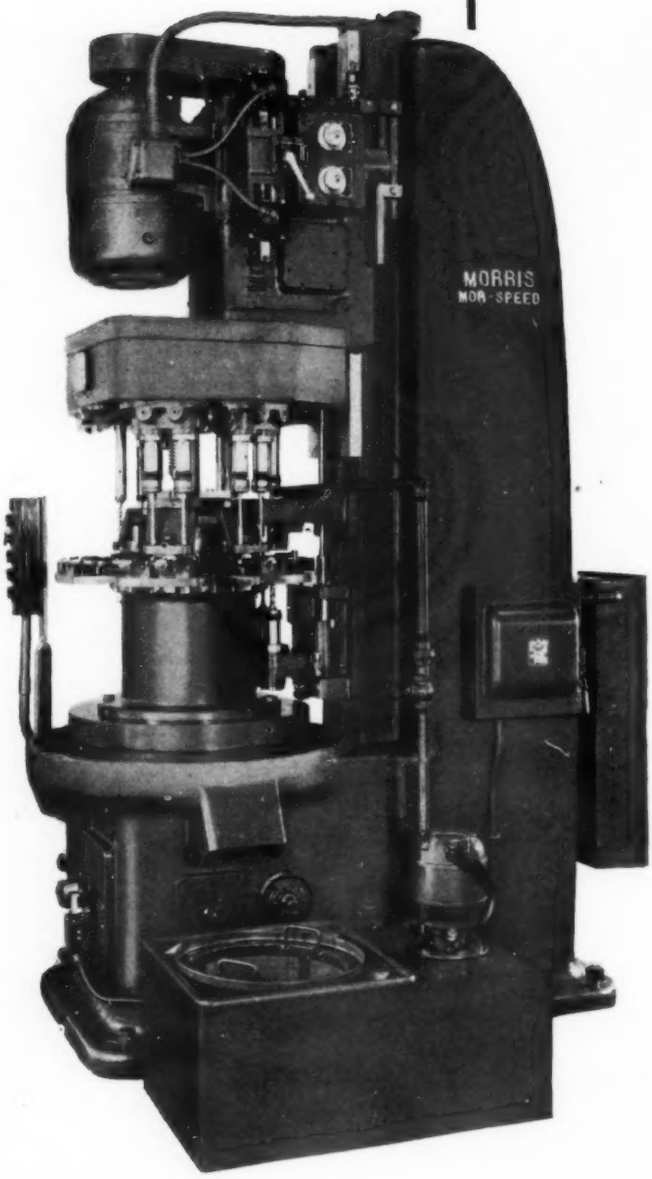
MOR-SPEED

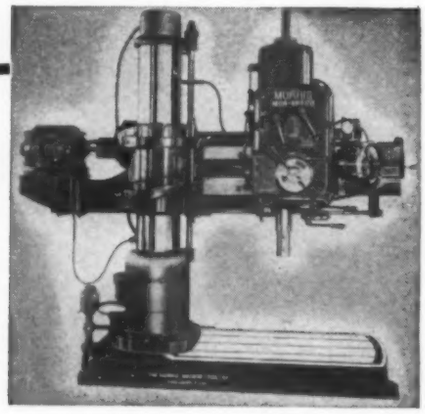
● This vertical hydraulic high production machine is typical of the units Morris is designing and building to meet job specifications.

Here the machine was developed for drilling, reaming and countersinking rocker arm steel castings for automobiles.

The standard hydraulic Unit carries a 10 Spindle Head. There are two inverted countersinking spindles which are fed up through lever action by Hydraulic Feed of upper unit. Cutting lubricant pump and reservoir are mounted on the side. Operation is simplified by push button control and automatic clamping.

For your high production work calling for drilling, reaming, tapping, etc., consult Morris. They have the organization, the facilities and the "know how" to help you.





MORRIS MOR-SPEED RADIAL

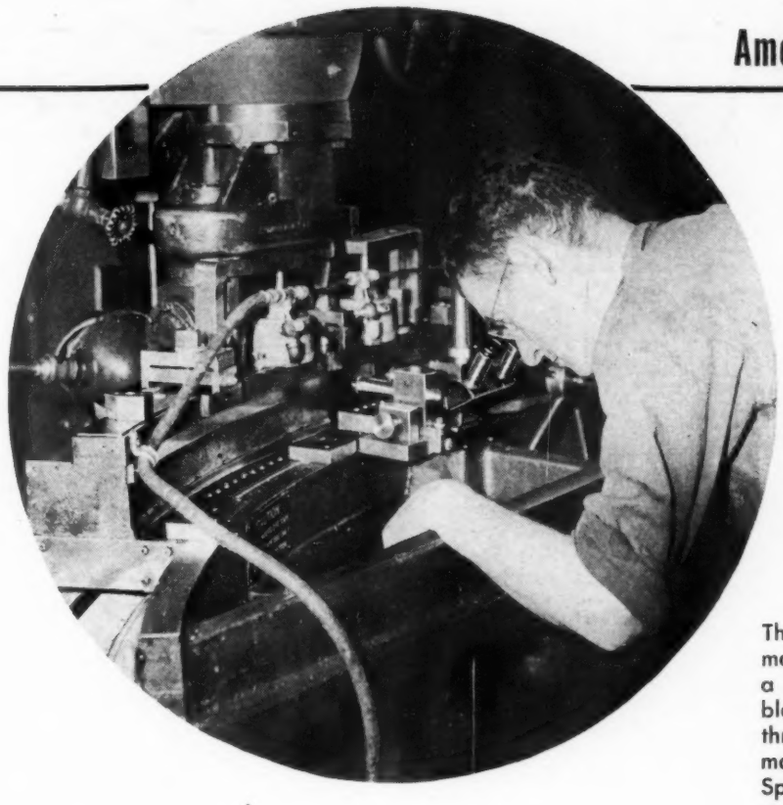
Builders of **MOR-SPEED** *Radials*

The **MORRIS** *Machine Tool Co.*

CINCINNATI 3, OHIO

ESTABLISHED 1877

American Machinist



This microscope-equipped master fixture is fitted with a fixture plate and scale block for precision drilling three 3/32-in. holes in a magnesium gearbox. Spacing between hole centers is held to plus or minus 0.0002 in. The milling machine used was specially modified for precision drilling and boring

Optical Locating System Takes Guesswork Out of Positioning

BY G. C. BECKER

DIVISION VICE PRESIDENT IN CHARGE OF ENGINEERING, MECHANICAL DIVISION, GENERAL MILLS, INC.

Method involving microscopes attached to special fixtures has wide field of application in precision drilling, boring, graduating and milling work

MICROSCOPES, used with master reference scales, were attached to special fixtures by the Mechanical Division of General Mills in developing a method for accurate positioning of parts in precision production. Applied readily in various precision graduating, boring, drilling and milling operations, the 'scope-and-scale system reduces inaccuracies inherent in most production locating fixtures.

Instead of depending entirely on metal-to-metal fits and the variable skill of individual operators, the method embraces optical precision and involves only three basic elements: (1) A standard 40X toolmaker's microscope, consisting of an eyepiece, reticle and objective, rigidly mounted on fixtures and focused on (2) accurately inscribed master reference scales or blocks attached to (3) special work-holding fixture slides capable of rapid, close-tolerance positioning.

Used extensively by General Mills for the past three years, the method was originated for producing high-priority naval fire-control equipment demanding precision tolerances. Chief advantages are:

1. Tolerances in spacing, holding bore locations and similar operations can be held to tenths consistently.
2. Reduces scrap loss to a minimum.
3. No special operator skill is required.
4. Reduces tooling costs.
5. Can be used for a variety of precision production jobs.

The value of optical spacing compared to mechanical methods is demonstrated in the manufacture of naval gunsight elevating bars to specified tolerances. The bar of medium carbon steel was about 48 in. long and curved to a 45.750-in. radius. Five bearing surfaces required parallelism of 0.0001 in. A 229-tooth gear rack had to be milled on the outer radius,

holding circular pitch of teeth to 0.0002-in. tolerance and limiting cumulative error from end-to-end of the gear segment to a maximum of 0.001 in.

Graduations had to be engraved on the inside radius in accurate relation to the gear rack so the total error, after running through a 72-to-1 ratio spur-gear train and a set of 1-to-1 spiral bevel gears, would not exceed plus or minus 7 min., 30 sec. at any point on the scale of a special protractor fixture. Each graduation had to be held to a width of 0.010 in. and a depth of 0.010 in., with a maximum variation of 0.0001 in. in spacing. Chordal length of the graduated surface had to be correct within 0.0001 in.

Precision-assembled mechanical indexing fixtures equipped with vernier adjustment features were first tried for milling gear teeth and graduating the bar. Each index pin passed through precision holes in three plates (top and bottom fixed plates with slide-plate between) and all holes were fitted with bushings ground and lapped to a tolerance of 0.0001 in.

Despite care and use of skilled technique for each production operation—including preliminary machining and correct heat- and cold-treatment to assure stability—the best bar produced had an error of 0.002 in. in chordal length of the graduated surface, and an error of 0.0015 in. in spacing of the graduations. Circular-pitch error of the rack teeth was also 0.0015 in. These errors were excessive.

Complete dependence on metal fits, variation in operators' touch, wear, deflection of pins, errors caused by dust getting into close-tolerance indexing holes were factors preventing attainment of desired accuracy, and consequently increased costs.

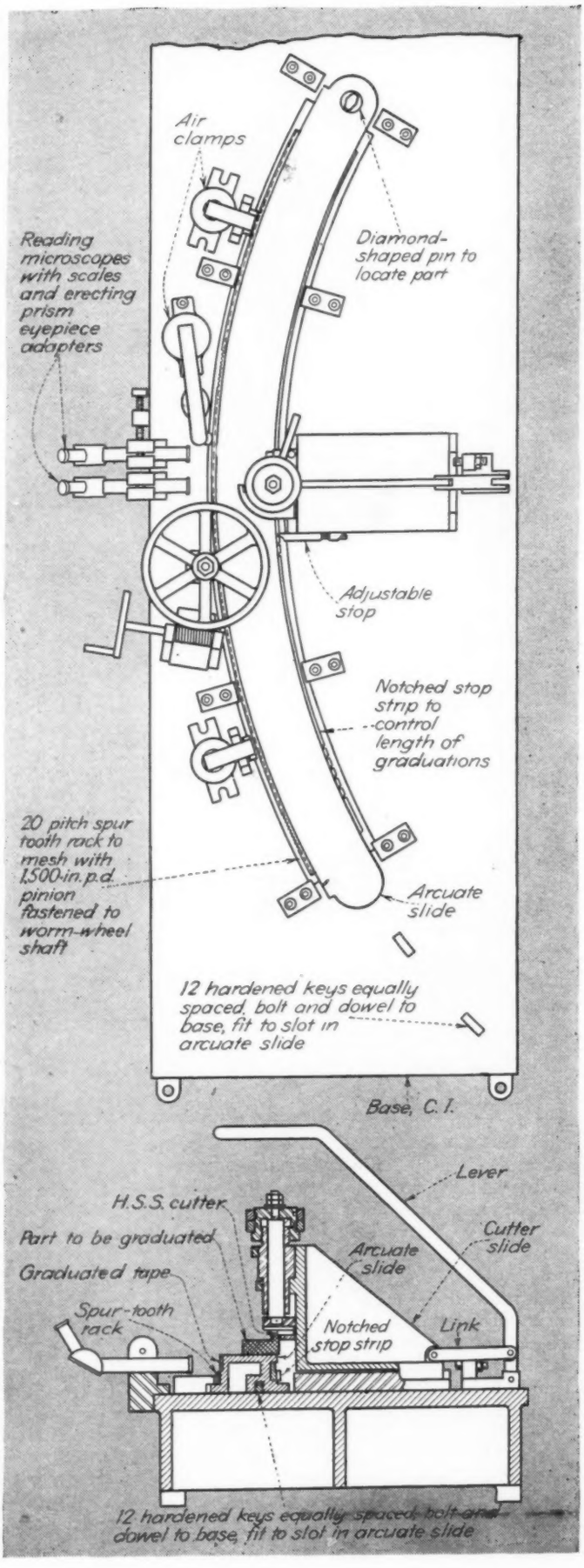
Special Fixtures Built

Engineers then designed and built special 'scope-and-scale equipped fixtures for optical positioning. In comparing protractor read-out values (taken with a 72-to-1 pinion) for bars made by both locating methods, the following results are significant:

The best bar obtained by mechanical indexing before the war had an error of plus or minus 18 min. of arc. Optical positioning has resulted in mass production of bars with an average error of only plus or minus 3 min.; the best bar was held to just half that.

To graduate by optical positioning, the bar is clamped to an accurately machined and finished arcuate slide which moves through the correct radius in curved ways on top of the 23¼×73¼-in. fixture base. The slide is moved by a handwheel equipped with a fine-adjustment worm gear which can be disengaged for rapid traverse.

A 20-pitch spur-tooth rack on the outer radial face of the slide meshes with a pinion on the handwheel shaft. Mounted on the same face is the important master-index scale—steel tape ¾ in. wide, 0.025 in. thick and about 46 in. long, bearing carefully engraved lines 0.0002 in. wide and 0.040 in. long. Engraving was done in a linear indexing machine by Gaertner Scientific Corporation after spacing dimensions had been determined by General Mills engineers.


Air clamps
Reading microscopes with scales and erecting prism eyepiece adapters
Diamond-shaped pin to locate part
Adjustable stop
Notched stop strip to control length of graduations
20 pitch spur tooth rack to mesh with 1.500-in. p.d. pinion fastened to worm-wheel shaft
Arcuate slide
12 hardened keys equally spaced, bolt and dowel to base, fit to slot in arcuate slide
Base, C. I.
Lever
H.S.S. cutter
Part to be graduated
Graduated tape
Spur-tooth rack
Arcuate slide
Cutter slide
Notched stop strip
Link
12 hardened keys equally spaced, bolt and dowel to base, fit to slot in arcuate slide

This assembly is mounted on a structural-steel bench for shop use in the production of elevating bars for naval gunsights. Work-locating blocks and clamps are mounted on top of the arcuate slide. Hardened-steel keys and hold-down blocks guide the slide

Calculations were made by various formulas (all agreeing within 0.000001 in.) to allow for tension and compression factors in mounting the tape on the curved fixture. Diamond-ruled lines on the scale are read with a 40X toolmakers' microscope having a ⅛-in. diameter field.

Two microscopes are mounted side-by-side on the fixture base. Each has a reticle scale and an erecting eyepiece adapter. The right-hand microscope is centered accurately with the centerline of the high-speed steel engraving cutter carried in the vertically adjustable cutter head. The second microscope is positioned a known distance from the first microscope so it is aligned with a scribed line on the scale when another scribed line is centered under the first microscope. This permits the operator to check a setting quickly before moving the cutter slide forward with the overhead lever.

The cutter slide carries an adjustable stop which contacts a notched stop strip on the rear of the arcuate slide to limit the forward travel of the cutter. Graduation lines of three predetermined lengths thus can be cut without attention from the operator. Each fifth line is made slightly longer than the unit lines and each tenth line is longer than the fifth-line graduations. Notches of proper depth are provided for each fifth and each tenth line, to permit the cutter the correct amount of additional travel. Unit lines are cut with the cutter-slide travel limited by the stop contacting the face of the stop strip.

Observes During Clamping

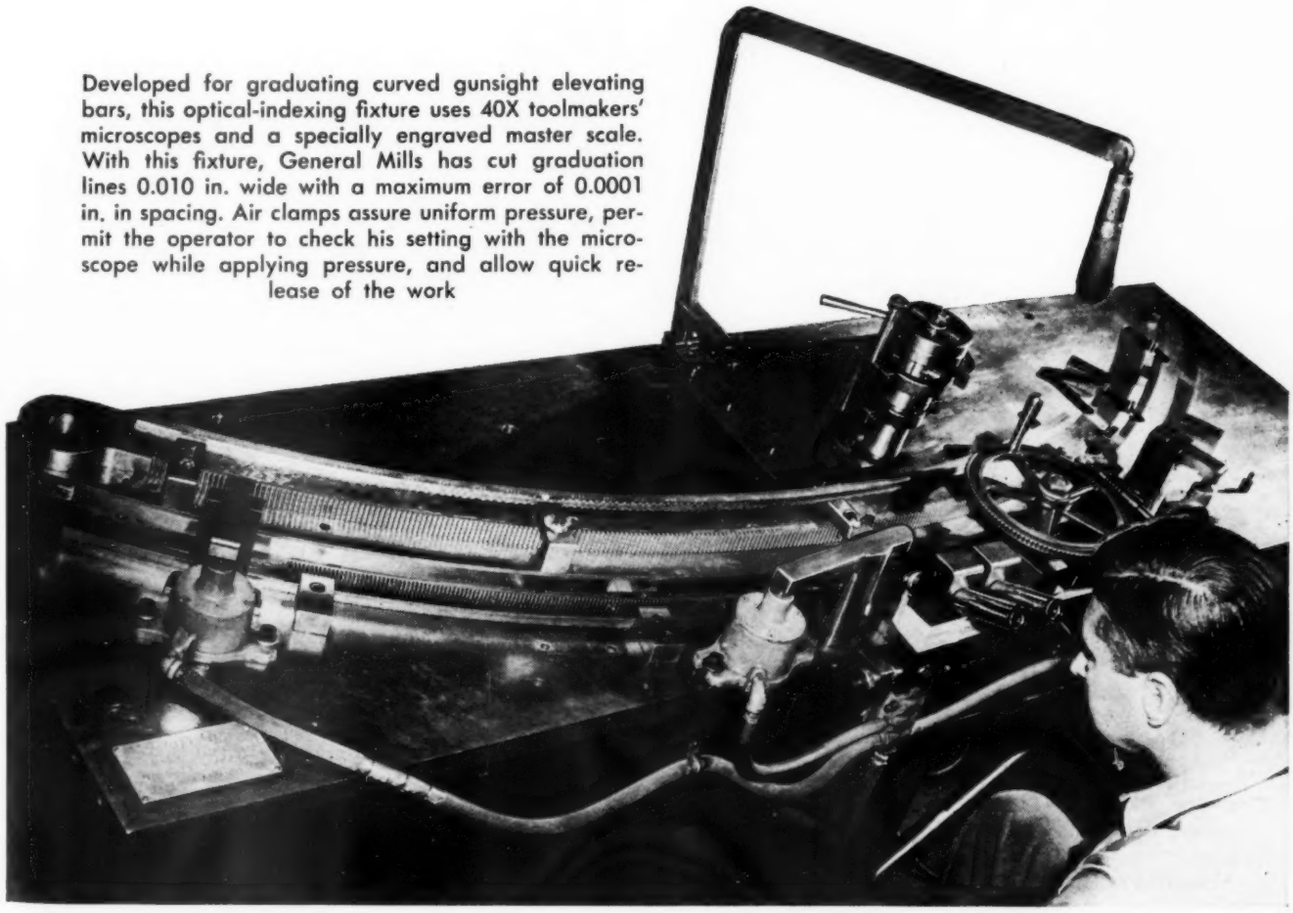
Three air-operated clamps hold the arcuate slide in position for cutting each graduation line. As the operator observes the scribed line on the scale through the setting microscope while applying air-clamping pressure, he can determine immediately if the application of this pressure causes the slide to shift its position. This could not be done if he had to use a wrench to clamp the slide mechanically.

After clamping the bar to the slide, the operator makes faint tattler marks with the cutter at ten-line intervals throughout the length of the part so a check can be made of the accuracy of the setup on the fixture. Positioning is done by aligning engravings on the master scale with the reticle in the right-hand microscope, double checking with the left-hand 'scope to detect possible errors in positioning. The bar is then removed from the fixture and the tattler marks are read out on a special protractor.

If the scale proves too long or too short, the location pods on the top of the slide, against which the bar is clamped, are moved in or out to change the radius of the path through which the bar moves. Correcting this radius 0.001 in. changes the protractor reading 4 min. 30 sec., so precision adjustment is important.

When the tattler marks check out accurately the bar is returned to the fixture, carefully relocated on the slide by means of a portable toolmakers' microscope, and then graduated. Each of the 0.010-in. wide and 0.010-in. deep graduation lines is cut with two passes of the micrometer-adjusted toolbit. Line width must be held accurately; tolerance on this dimension is plus 0.000 in., minus 0.001 in. The bar is repositioned for each graduation as when making the original tattler marks, by moving the fixture slide to bring the scale graduations successively into correct alignment with the two fixed microscopes.

A similar fixture incorporating optical-spacing equipment was constructed for precision spacing the teeth in the gear rack on this elevat-



Developed for graduating curved gunsight elevating bars, this optical-indexing fixture uses 40X toolmakers' microscopes and a specially engraved master scale. With this fixture, General Mills has cut graduation lines 0.010 in. wide with a maximum error of 0.0001 in. in spacing. Air clamps assure uniform pressure, permit the operator to check his setting with the microscope while applying pressure, and allow quick release of the work

ing bar. Error in spacing between individual teeth was held to 0.0001 in. and the total accumulated error over the length of the rack was held to 0.001 in. This fixture was mounted on the table of a heavy-duty vertical milling machine. A special right-angle cutter head also was developed for this rack-cutting operation.

Another example of 'scope-and-scale equipped spacing fixtures involves modification of a small vertical milling machine by fitting a special high-speed drive motor with new bearings, and a special spindle.

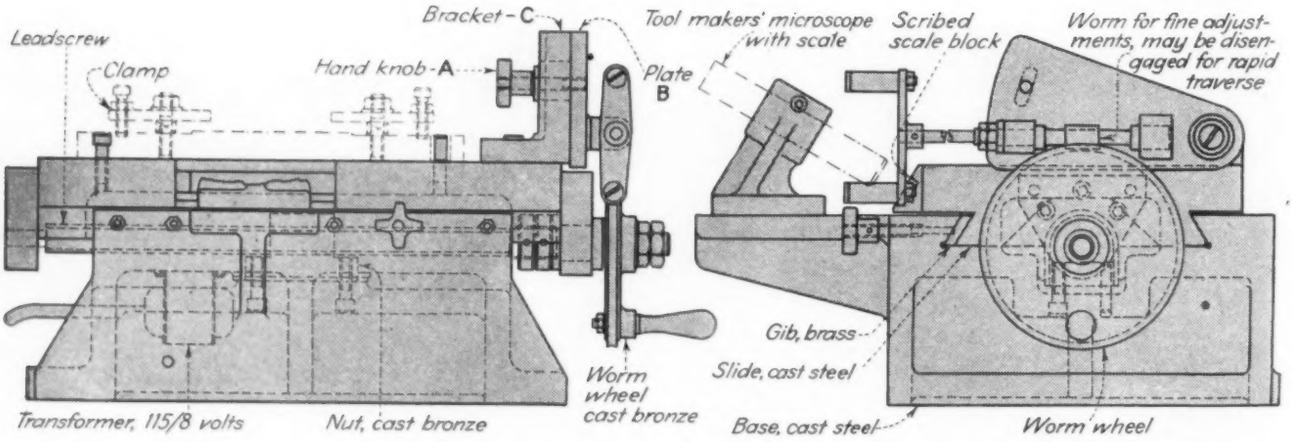
A standard toolmakers' microscope, rigidly mounted in a bracket on the base, is focused on an engraved master reference-scale block fastened to the fixture slide. The $\frac{3}{4} \times \frac{1}{4} \times 4\frac{1}{4}$-in. scale block, graduated in the General Mills toolroom, bears carefully scribed marks 0.0003 in. wide and 0.0002 in. deep, spaced with an error of less than 0.00005 in.

The master fixture is arranged so work-locating and clamping jig or fixture plates can be interchangeably bolted and doweled to the slide. This feature makes it possible to use the same master fixture for a number of jobs—a change in setup involving only the mounting of the proper fixture plate and scale block for the new part. Stop blocks or pins locate the work on the fixture plate in correct relation to graduation lines scribed on the scale block.

The master fixture has only longitudinal adjustment of the slide. Ordinarily, interchangeable fixture plates mounted on the slide are arranged so holes to be drilled or bored are in line with the longitudinal movement of the slide. Transverse movement can be obtained only by adjustment of the table of the miller, which usually is locked in place.

The toolmakers' microscope serves the same purpose as those employed in the graduating fixture for gunsight elevating bars. The operator observes the scribed line on the precision scale and positions the fixture slide by operating the precision worm and wormwheel adjustment of the screw operating the fixture slide.

Like the graduating fixture for elevating bars, this air-clamp fixture for cutting 229 rack teeth in one setting employs two toolmakers' microscopes and a precision-graduated scale for spacing the teeth. A special cutter head was developed. Chordal is held to 43.338 in., plus or minus 0.001 in.



This master fixture was developed for precision spacing between holes in drilling and boring operations. For rapid traverse of the slide, worm shaft is swung upward away from the wormwheel by loosening handknob A and raising plate B. Stud for clamping handknob extends through slot in bracket C carried on the fixture slide

Applying Electrons to Current Flow

IF WE FORM an electric circuit by connecting the positive and negative terminals of a battery to opposite ends of a conductor, an electric current will flow. The positive terminal of the battery attracts the negatively charged "free" electrons in the conductor and so produces a flow of electrons in one direction. The electronic flow is from negative to positive, which is directly opposite to the conventional idea of current flow from positive to negative, an idea that was arbitrarily adopted over a century ago.

In terms of electronic flow, the free electrons which move through the conductor to its positive end are immediately replaced by electrons from the negative end, resulting in a drift or movement of electrons around the complete circuit. The actual transmission of electrical impulses through the conductor takes place at a speed of 186,000 miles a second. However, the movement of individual electrons from atom to atom in a wire or conductor—"electronic drift," as it is called—is comparatively slow, probably not more than a few inches a minute.

The electronic tube in its simplest form is the two-element, high-vacuum tube used for changing a.c. to d.c. This tube has four basic parts: the cathode, the anode, the envelope and the terminals. The two most significant are the cathode, which gives off electrons, and the anode, which receives them. An envelope of glass or metal incloses the first two parts and thus forms the outside of the tube. The terminals connect the tube into a circuit.

To provide a free path for electrons to travel between the cathode and the anode, a high vacuum is formed by pumping all the air possible out of the envelope. A symbol is used in schematic diagrams to designate this type of high-vacuum tube. When the tube is hooked into a circuit, and a positive charge is applied to the anode, negatively charged electrons from the cathode stream across the space to the positive anode.

Classifying Electronic Tubes

One way to classify these tubes is by the type of cathode used. In some types, we boil the electrons out of the cathode with heat, much as steam is boiled out of water. In fact, heating the cathode is one of the most widely used commercial methods for insuring an adequate, uniform supply of electrons. All electronic tubes using heated cathodes are called *thermionic*. In actual operation, the cathode is heated by either of two methods.

The simplest method is by making the cathode itself of some high-resistance material, such as tungsten, and then passing an electric current directly through it as in a lamp filament. When the cathode is heated directly, it is called a directly heated cathode or filament. In general, directly heated cathodes are used where a quick-heating cathode is required. A symbol indicates this type of an electronic tube.

The second method is by building the cathode in the form of a tiny electric stove. An electric heating coil called the heater, inside the cathode, heats it to the proper temperature. When a separate heater is employed, the cathode is called an indirectly heated cathode. Indirectly heated cathodes are used where a uniform electronic flow is required at low anode voltages.

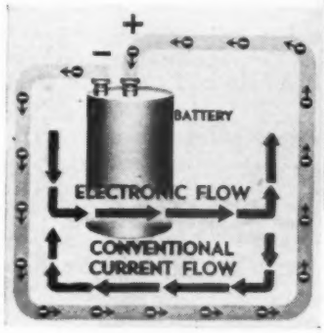
There's another type of electronic tube known as the cold-cathode tube. In this type, a high positive voltage makes electrons jump the gap between the cold cathode and anode, much in the same way as a spark is made to jump the gap in a spark plug. Another cold-cathode tube uses a pool of mercury for the cathode. The most common of these tubes is the ignitron, in which a third element called the ignitor starts electronic emission which is then maintained by the action of the electron flow within the tube.

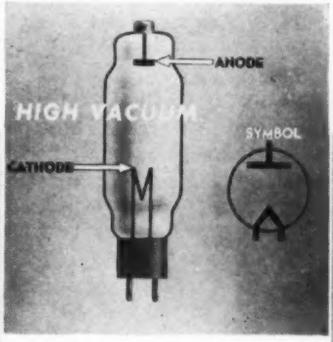
In still another type, we can produce electronic emission by shining a beam of light onto a cathode made of light-sensitive material. Such tubes, called phototubes, emit electrons the instant a light beam hits the cathode.

The X-ray tube employs another but less common type of electronic emission. In this type, tremendously high voltages on the anode, sometimes millions of volts in strength, draw electrons to the anode or target with the anode with such terrific impact they shake the anode atoms almost to pieces. It is these disturbed atoms, settling back to normal, which give off the radiations we call X-rays.

Based on a sound slidefilm in the General Electric industrial electronics course.

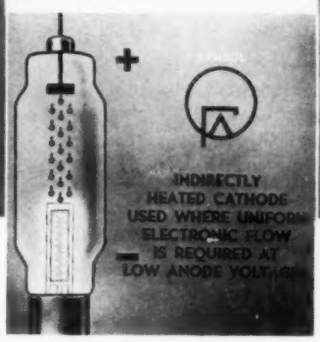
"Free" electrons flow from the negative to the positive terminal of a battery

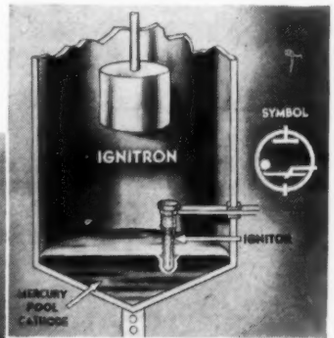




A high vacuum provides a path for electrons to travel from cathode to anode

An electric coil inside the cathode brings it to the proper temperature in indirect heating





The ignitron tube uses a pool of mercury as a cathode and has a separate ignitor to start emission

Gear-Tooth Finish Improved by Burnishing

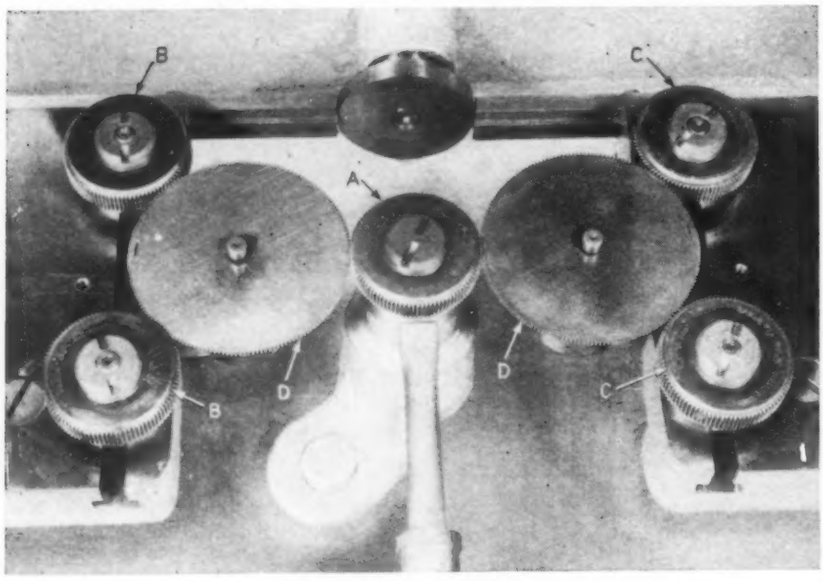


Fig. 1—The driver *A* simultaneously rotates gears *D* while the burnishing gears *B* and *C* are pressed against them

BY G. H. SANBORN, CHIEF FIELD ENGINEER,
FELLOWS GEAR SHAPER COMPANY

CONSISTENT finishing of truly good gears is no accident, nor is it the result of hit-or-miss methods. First a reasonably accurate roughing or stock-removing operation must be performed on a properly prepared blank. Then the finishing of good gears can be accomplished by various methods, such as accurate second cutting, burnishing, shaving, lapping and grinding. The best method to employ depends upon the accuracy desired, design of the gear body, whether it is to be hardened or not, and what surface finish is required.

The burnishing of gear teeth is not as widely used as some other methods, but does have a definite field. The operation is accomplished by rolling the work gear in a nest of three accurate hardened and ground gears, known as burnishing gears. They are rotated in one direction, then in the other, under radial pressure. It is a cold-rolling operation and sets up the usual internal stresses resulting from the cold-rolling of metals. If the work teeth are corrected appreciably during the burnishing operation and then hardened, these internal stresses are released, and the original errors reappear to a somewhat reduced extent, but they are definitely there. For this reason, gears are seldom burnished if they are to be hardened.

If gears are going to remain soft, and a high degree of accuracy and finish is required, burnishing is a desirable finishing operation. By this method, the profiles and spacing of the work teeth can be improved materially. The eccentricity of the work pitch line relative to the locating surfaces is not reduced, because the pressure is the same on all points of the gear.

The above points can be clearly seen by making a Red-Line chart of the work gear at different stages of production. The amount of wave in the line shows the change in center distance between the work gear and a master gear which in turn, indicates the amount of composite error in the work. The first line would show the gear as it came to the burnishing operation, a second line after burnishing, and a third line after hardening. It would be noticed that after burnishing the error was definitely reduced, but after hardening, it was nearly back to the original amount. This shows that little is to be gained by burnishing if heat-treating follows. Sometimes hardening distortion is so great the above is not discernible.

Burnishing improves the finish, giving a smooth glossy appearance. This is not just a matter of looks. As the gears come from the cutting operation, they have unavoidable lines of one kind or another, depending on the method employed in cutting. These lines are detrimental to the smooth running of gears such as those found in instruments and especially when they are run with practically no backlash. The fine finish resulting from burnishing adds greatly to the smoothness of operation of soft gears. The working surfaces of the gear teeth are slightly hardened by the burnishing operation, thereby lengthening their life in most cases.

Some gears are burnished after hardening, but it should be clearly understood why it is done. It is not to improve profiles, spacing or finish. It is to assist in the removing of nicks. One of the chief headaches in gear manufacture is avoiding when possible and removing where necessary nicks from the tooth profiles. Hard burnishing of gears makes the small nicks ineffective and shows up the large ones, which are removed with a hand grinding wheel.

Burnishing gears are generally used until they are worn beyond usable accuracy, then returned to the manufacturer for regrinding. Burnishing gears used on soft work can, in most cases, be reground several times before they must be discarded. Their life can be increased, when burnishing narrow face width work, by periodically positioning the work at different heights to distribute the wear evenly across the face of the burnishing gear. When working on hardened gears, the burnishing gears are seldom reground. On this type of work, high pressures are used and the life is usually determined by breakage.

When burnishing soft gears, it is necessary to use some sort of lubricant to avoid abrasion and obtain the desired smooth finish. Regular machine oils are not satisfactory in that they give too much lubrication and lengthen the time required for the operation. Three parts of kerosene

and one part of light machine oil gives sufficient lubrication and a fast production time

The times required for burnishing are extremely short. One example of fine-pitch work is as follows: A 32-pitch spur gear, 4-in. pitch diameter, 1/16 in. thick, is burnished at the rate of 480 per hr., per machine. Another example is a 40-pitch spur gear, ½-in. pitch diameter, 3/16-in. face, being burnished at the rate of 600 per hr., per machine. When burnishing thin gears, it is not practical to stack them unless they are kept in loads, clamped together as they were cut; otherwise, the slight variation in size from one gear to another would cause one gear to take all the pressure and the others none.

Some attention must be paid to the diameter of the burnishing gears. The ratio between the size of the burnishing gears and the work is not particularly important, but when using three burnishing gears on each piece of work, as is usually the case, there is a maximum limit to their size. This limitation comes when the outside diameters interfere with each other. For example, if we were to try to burnish a 1-in. diameter, 10-pitch pinion, with a set of 5-in. burnishing gears, the burnishing gears would hit each other before they would press the work.

The life of burnishing gears varies considerably, as would be expected. This depends primarily on the size and hardness of the work. The pressure used also influences their life. Even though there is some variation, the average life of a set of burnishing gears on soft work is found to be from 20,000 to 40,000 gears per grind. The rotary speed at which burnishing gears are usually run is between 200 and 400 ft. per min., pitch-line.

Fig. 1 is a close view of the burnishing gear and work arrangement in a burnishing machine. The five gears *A, B,* and *C* are the burnishing gears, the two gears *D* are the work. Burnishing gear *A* is the driver of the complete gear train. This type of setup permits the burnishing of two pieces of work at a time. These two pieces can be the same size, or they can be of two different numbers of teeth, as long as both gears are of the same basic proportions, such as pitch and pressure angle. A setup of this type is shown in Fig. 2. At the right, a small shank pinion is being burnished; at the left is a larger gear, often the mating member.

The work in the illustrations, so far, has been spur gears which do not have to be held down while burnishing, but helical gears do have to be held down to keep them from climbing out from between the burnishing gears when running in one direction. As pointed out earlier, the gears are rotated in both directions during the operation. While running one way, the thrust of the work is down; but in the other direction, the thrust is up and must be taken care of. A proper setup for helical gears is shown in Fig. 3. The arms *M*, which are quickly swung in and out of position, serve as stops but not as supports for the two helical gears.

To avoid damage to the work or burnishing gears, the pressure is not applied until the gears have started rotation. The pressure is applied by a simple mechanism employing weights, so it can be definitely controlled. There are separate weights for each of the two pieces of work. This is to permit, as in Fig. 2, the use of more weight for the large gear on the left than for the small pinion on the right. By doing this, both pieces of work are done in the same time.

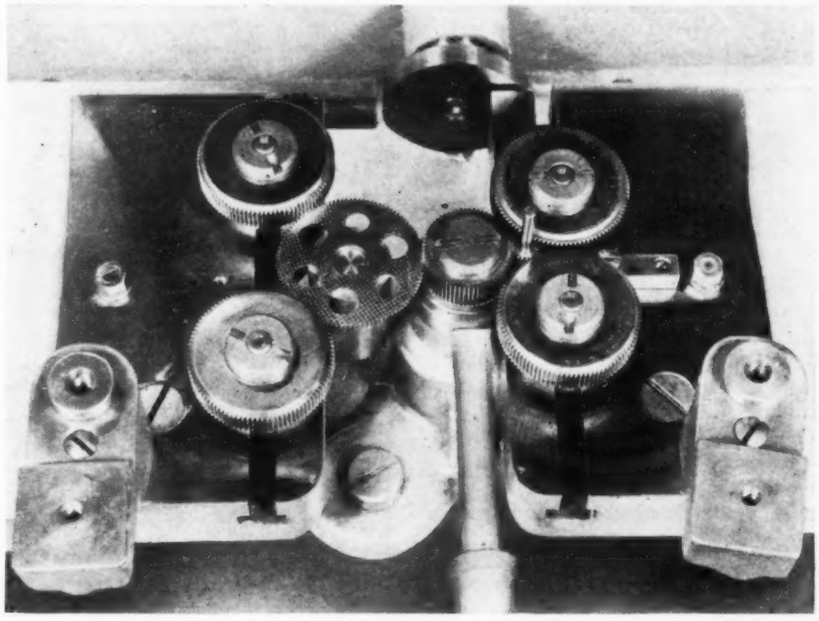


Fig. 2—It is not essential that gears burnished at the same time be of the same size as long as the pitch is the same. Here a mating pair is being burnished

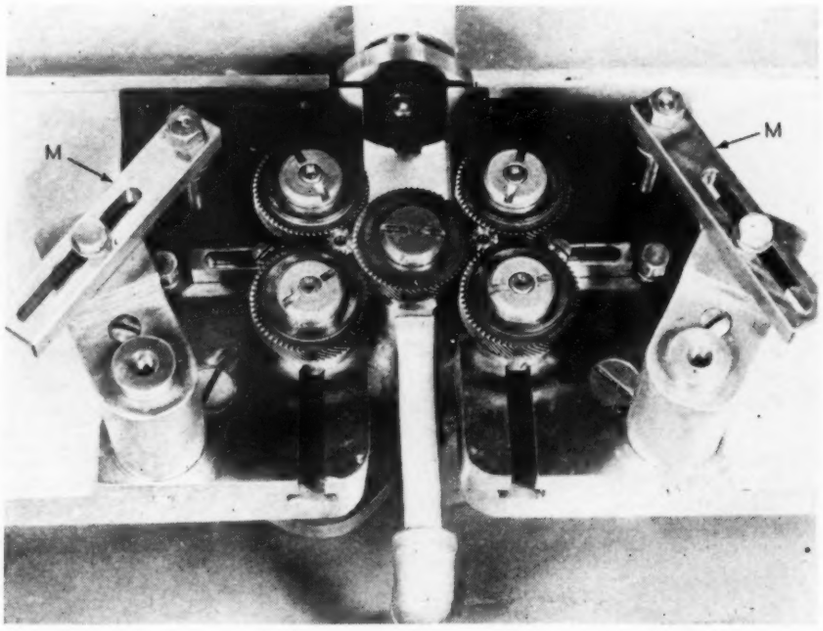


Fig. 3—Helical gears, when burnished, tend to work out of the burnishing gears. Arms, such as those at M, are swung over the work to serve as stops

Fixed-Angle Photos Simplify Explosion Sketches

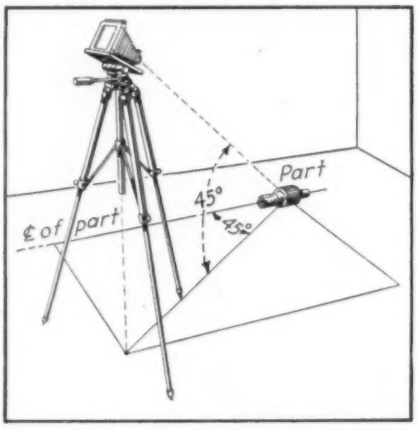
BY R. B. WITTMAN, AIRCRAFT SERVICE DEPT., FORD MOTOR COMPANY

Parts grouped in proper assembly positions and photographed from standard angles assist draftsmen in making clear perspectives for guiding new production projects

DURING THE WAR, thousands of people who had never read a blueprint in their lives were able to do unusually complicated jobs with success when guided by perspective drawings. These drawings were used to show parts so they could be visually identified by workmen who had to order them by number. Many parts, for security reasons, were not named to prevent disclosure of their function, but even if they had been named, it is doubtful whether they would be identifiable by description only because of their complexity.

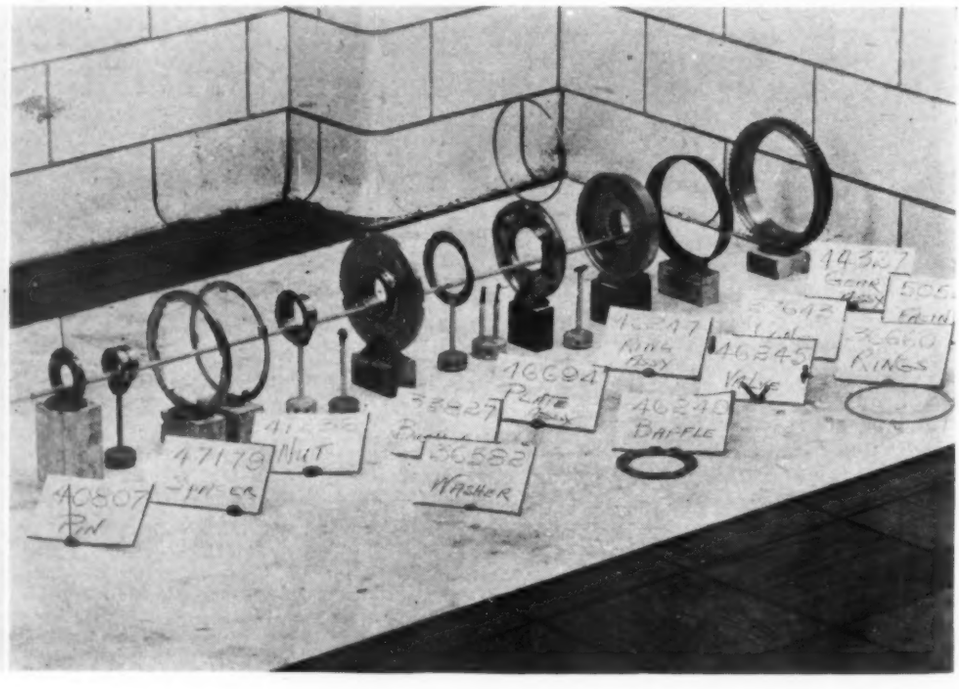
What applies to the factory mechanic also fits the field repair and maintenance man. He also must find out the assembly sequence before he tries to dismantle any unit, so the "exploded-assembly" drawing has become a most useful tool for him as well.

For many years in the service-parts departments of the industry, parts have been illustrated photographically. Usually, the various units of an assembly were spread out on the floor and a photograph taken from a high point above them, or in some cases from directly above. Some studios even had a heavy ground-glass plate on which parts were laid. By illuminating this from below, a sharp outline around each part was obtained on the negative and retouching was eliminated. Part numbers were shown on cards placed close by so there was no difficulty in identifying both the part and its number. Parts shown by the old method did not indicate their arrangement and assembled relationship, and this factor promoted development of the "exploded-assembly" drawing, both for service and for worker training.

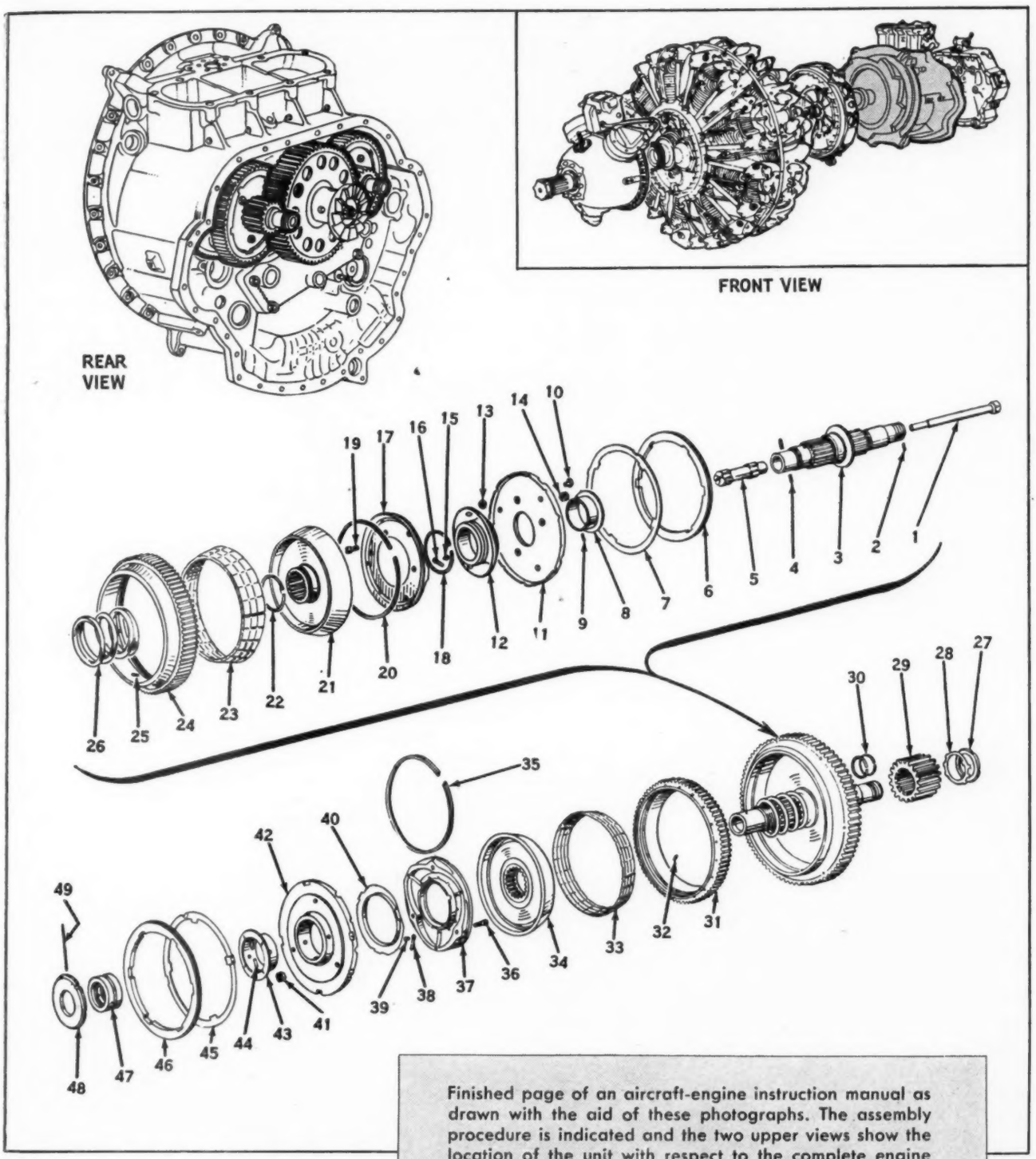


Camera position is 45° to left and above the object or centerline of the group of parts being photographed

The chief difficulty has been in obtaining artists capable of converting three-view orthographic plans into perspective. Draftsmen had to be trained for this kind of work, and to assist them, projection guide paper



Parts of a double-cone clutch assembly shown in an exploded photograph to aid draftsmen in preparing perspective drawings. The parquet floor and tile wall help align the parts at the desired 45° angle. Parts are aligned by a dowel. Each piece is held in proper position by "Tinkertoy" units, modeling clay and small wood blocks



Finished page of an aircraft-engine instruction manual as drawn with the aid of these photographs. The assembly procedure is indicated and the two upper views show the location of the unit with respect to the complete engine

was developed. This material is available in many projection angles. With it, a draftsman can lay out accurately a perspective drawing using dimensioned blueprints.

To simplify the art work at Ford, it was decided to view all parts and assemblies from the same angle. In the beginning, preliminary drawings are required to assist in the initial assembly stages, but as parts become available, they are photographed and final finished drawings produced. One advantage of this system, in which all drawings and photographs are taken from the same angle, is the ease of introducing production changes or "Mods" as they come into effect.

At Ford, the angle chosen for all drawings was 45° left and 45° above center-front-horizontal. When a rear view of a part was required, the camera was moved 90° more to the left, viewing the part from 45° left rear instead of left front. Fixing these angles made it easier to produce both photographs and drawings and easier for the shopmen to read because they always looked at the parts in the same way; they never had to reorient themselves to understand how the parts went together. Anyone who has

had to work with English blueprints will understand how important it is for everyone in a shop to see the parts from the same angle. English drawings are first-angle projections, while American are third-angle. Americans draw an airplane as though looking down on it, while the English always present a worm's-eye view.

To facilitate taking photos at Ford, parts are arranged on a parquet floor. Placing the camera at a 45° angle is done easily by lining it up, using the diagonals of the floor blocks as a guide. Arranging parts in a corner permits using the walls to support the white background and any reference data photographed with the parts.

Original photographic work, duplicates or corrections are ordered on 3×5-in. cards tabulated with standard descriptive data. One card for each part facilitates individual changes. Material for each photograph is kept in one 12×15-in. envelope on which the figure number is clearly marked.

Several numbering systems are used concurrently. Usually, part numbers are chosen to indicate their location in each successive subassembly with the duodecimal system. For explanatory exploded drawings, index numbers replace complicated lettering. Then, the illustrations must be numbered. The more complicated the finished unit, the more numbering is required. Thus there may be six or more digits, but individual numbers can be subdivided with decimal points or hyphens for readability, always maintaining a logical system. In a unit as as large as a complete engine, the most insignificant gasket could be located quickly by reference to its complete number. Many standard practices have been developed for neatness, clarity and simplicity. Index numbers, for example, are arranged in numerical order, wherever possible, on the drawings, regardless of relative importance or size of parts. In a typical rectangular illustration which approximately fills the space uniformly, arrows radiate from an imaginary center to the four sides, and numbering is clockwise with all numbers neatly in rows. Arrows must never be parallel to any line in the drawing itself, and under no circumstances can they be exactly horizontal or vertical if there is any chance of confusion.

Methods used in preparing mockup exploded-assemblies for photographing are shown. Various-shaped rectangular blocks not only hold the parts at the correct height for axial alignment, but also can be made to indicate the correct perspective to the artist. Wood dowel rods "string" certain parts, and modeling clay makes unstable parts stand in position.

Grant Surplus Machine Tools to Schools

PUBLIC, trade and engineering schools engaged in training the mechanical engineers and production men of tomorrow represent an enthusiastic reservoir for grants of surplus machine tools. Up to Dec. 1, schools in the Cleveland area have been allotted approximately $657,000 worth of lathes, drillpresses and other tools—schools paying only crating and freight charges, according to Cleveland Ordnance District.

Machine-tool builders and distributor organizations started a movement as far back as July, 1945, to have a vast number of surplus machine tools turned over to schools. Investigation reveals that both Army and Navy officials have authority to dispose of surplus tools as a direct gift to proper schools after necessary forms are approved. RFC, on the other hand, only can sell surplus tools in its care to schools at a 40% discount.

Vocational departments of Cleveland public schools have been allotted $91,598 worth of tools; Case School of Applied Science is receiving $34,400 worth of lathes and milling machines for its mechanical engineering department; and Fenn College is granted $23,945 worth of tools. Suburban public schools will receive the balance.

Virtually all of the machine tools turned over to the Cleveland public schools are standard types. Buffalo school authorities, however, have taken steps to procure many of the more complicated machine tools from surplus lists, according to word received by the American Machine Tool Distributors' Association.

A number of special and more complicated machine tools have been installed in vocational departments of Buffalo schools together with samples of the products each is capable of producing. Advanced students receive detailed instruction from teachers on operation of the machines.

Keen interest in the practical side of operating a milling machine is exhibited by high school students being taught by Frank Trella

Mandrel Limits Ground-Hole Accuracy

BY FREDERICK C. VICTORY, CHIEF ENGINEER MOORE SPECIAL TOOL COMPANY

Since publication of "Small Hole Grinding With Diamond-Charged Mandrels," the author has compiled data that show how deflection of a mandrel limits its ability to correct holes to those within a specific ratio of length to diameter

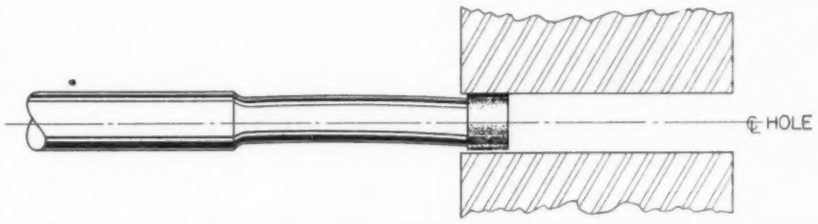


Fig. 1—Grinding cannot be accomplished unless some force is applied, but any force will deflect the mandrel, which is in effect a cantilever beam with the load concentrated at the free end

WE DO NOT ADVOCATE the grinding of holes with a depth more than six times their diameter. The stiffness of the mandrel will be so much reduced that the mandrel will bend and follow the existing surface, instead of correcting it.

The mandrel may be compared to a cantilever beam, held rigidly at one end, the load at its free end represented by the pressure, or force, required to make the abrasive particle penetrate the work, Fig. 1. The amount of deflection is directly proportional to the force, and inversely proportional to the rigidity, or stiffness, of the beam.

The formula for deflection D at the end of a round cantilever beam is:

$$D = \frac{F L^3}{3 E \left(\frac{\pi d^4}{64}\right)}$$

where F=the deflecting force, applied at end

L=length from point of support to end

E=modulus of elasticity of material

d=diameter of the beam

From this formula it is evident that the deflection increases directly as the *cube* of the length, and inversely as the *fourth power* of the diameter.

We have no means of ascertaining specific unit pressures required to accomplish efficient grinding, either with diamond mandrels or abrasive wheels. We find experimentally, however, that when the six-to-one ratio is exceeded, loss of rigidity of the mandrels, and consequent inefficiency of grinding, increases at such an enormous rate that it is impractical.

As an example, take three hypothetical mandrels, *A*, *B* and *C*, Fig. 2, assuming and applied force F sufficient to bend, or deflect mandrel *A* by 0.0005 in.

Reduction of the diameter from ¼ in. to ⅛ in., as in *B*, reduces its rigidity and, therefore, increases its deflection in the ratio of 2^4, or 16. The same force F will now deflect it 16 times as much as mandrel *A*, or 0.008 in.

Doubling the length, as in *C*, increases the deflection again by 2^3 over *B*, or by 2^7, or 128 times that of *A*. The same force required to deflect mandrel *A* by 0.0005 in. will deflect mandrel *C* by 0.064 in. or over 1/16 in.

These cases are hypothetical since we do not know absolute pressures or deflections; they serve to illustrate the enormous *rate* of *loss* of grinding efficiency with slender mandrels.

The stiffness of the mandrel may be improved by keeping its diameter large in proportion to the hole, but this does not insure grinding efficiency. The cutting part of the mandrel must always be larger than the clearance portion. As the cutting part approaches the diameter of the hole, the arc of contact also increases, resulting in lower unit pressures and consequent loss of grinding efficiency.

The only other way of increasing the stiffness of the mandrel, that of employing a material of higher elastic modulus, is circumvented by the fact that a steel bar has the highest modulus of commonly used materials.

These characteristics appear, at present, to limit definitely the practical grinding of holes to the above maximum ratio of depth to diameter.

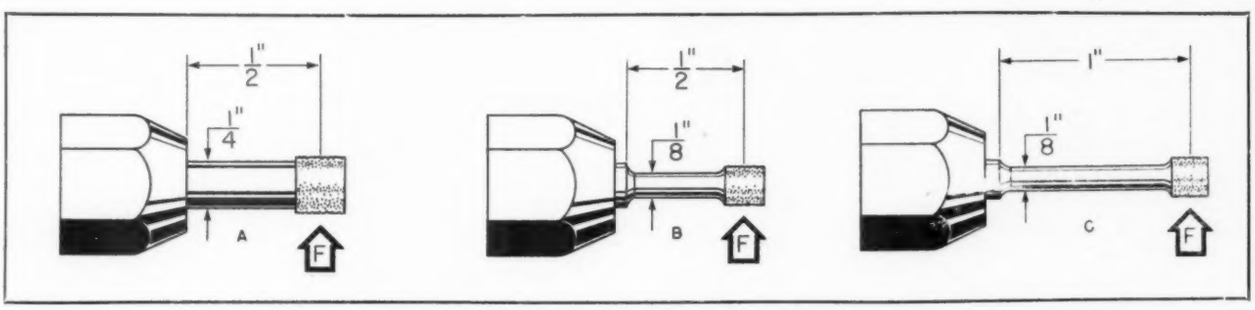
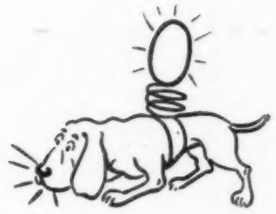
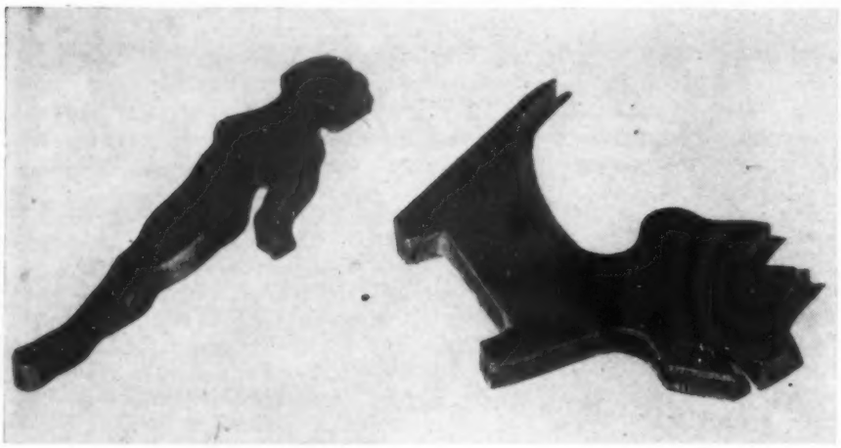


Fig. 2—In comparison with *A*, the deflection of the mandrel rises sharply with a decrease in diameter as at *B*, and pyramids when the diameter is decreased and the length is increased as at *C*

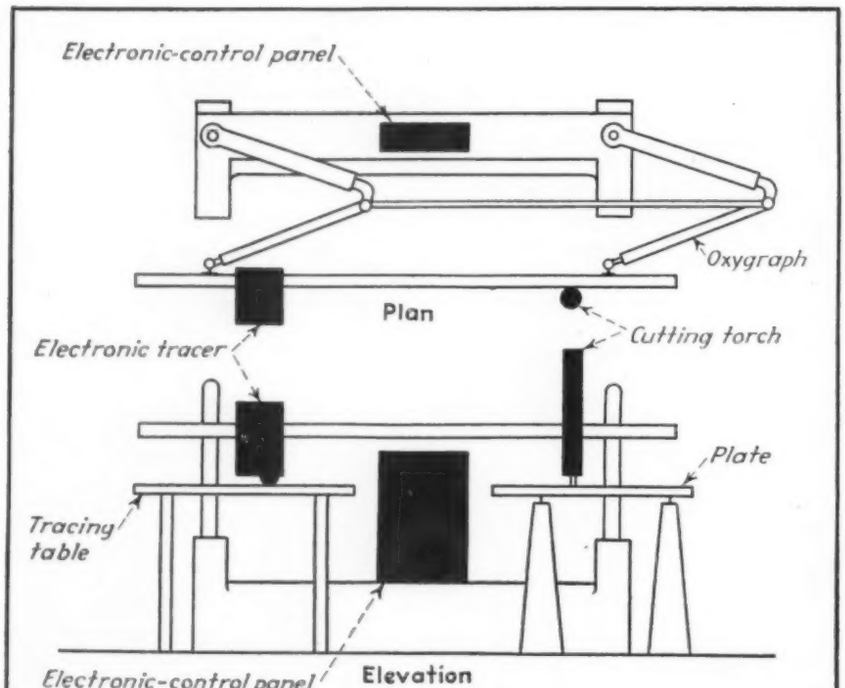


Electronic Bloodhound Guides Cutting Torches Accurately

BY DR. G. V. SLOTTMAN, APPLIED ENGINEERING DEPARTMENT, AIR REDUCTION SALES COMPANY



Two sample cuts, each produced in a single operation, show the ability of electronic-tracing equipment to follow any angle, contour or corner accurately



Plan and elevation showing arrangement of electronic tracing head and control box on standard pantograph cutting machine

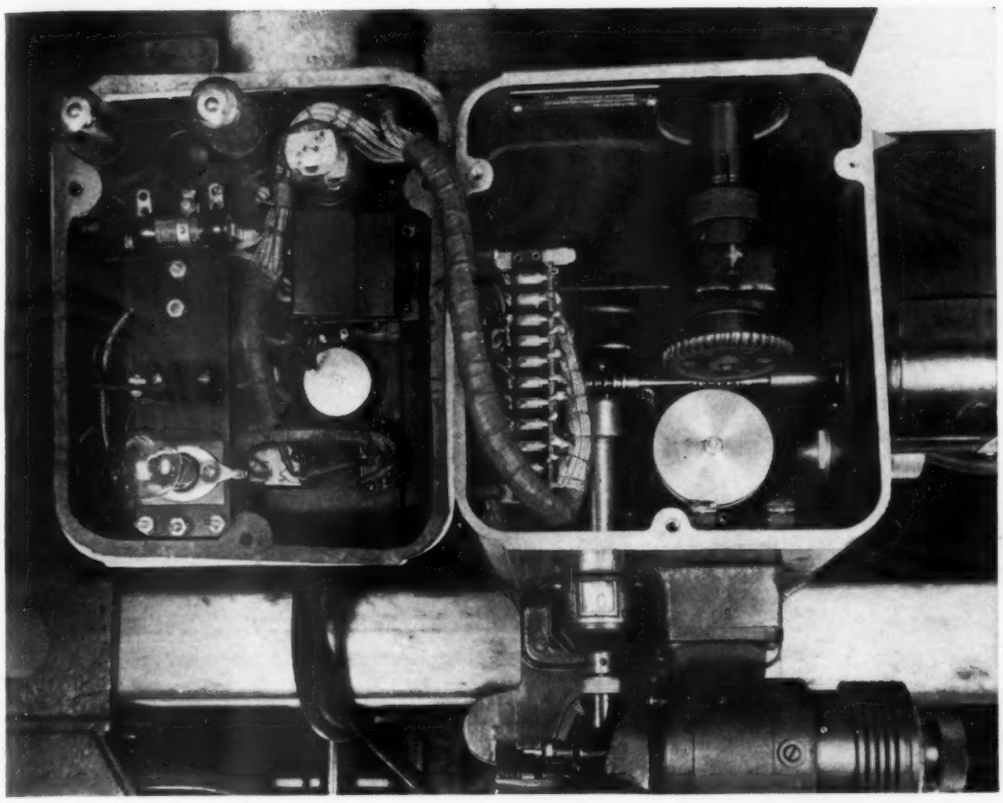
Beam follows complex shapes on inexpensive paper templets and thus directs torches in cutting steel parts to close dimensions

INTRODUCTION of electronically controlled tracing for standard pantograph-type oxyacetylene cutting machines has radically simplified steel cutting operations—for the first time making intricate design-cutting fully automatic—and, consequently, expanding the present application of torch-cutting machines in industry. The new device, popularly known as the "Electronic Bloodhound," eliminates metal and wood templets and all other mechanical or manual auxiliary guiding devices.

Electronically controlled tracing equipment cuts the most complicated shapes with precision merely by tracing automatically outline drawings or silhouettes of the desired piece. Two sample cuts illustrated show there are no limitations to the variety of designs which may be cut because the electronic tracing head follows complex angles and curves with accuracy.

Until recently, the most automatic and accurate tracing for machine cutting has been accomplished with a magnetic tracing device. The many steps, including careful machining to close dimensions for accurate cutting, involved in the preparation of a steel templet for use with magnetic tracing equipment and consequent high cost have limited magnetic tracing largely to production cutting.

When complex cuts are necessary, intricate sections often require subsequent cutting. The most accurate of templets are limited to the ability of the tracing device to follow the templet contour, making complex shapes cut to close dimensions impossible without the use of elaborate jigs and



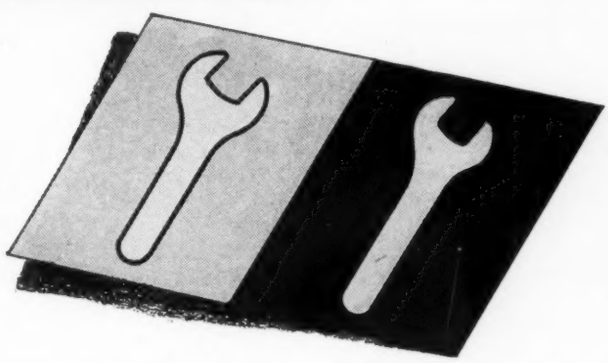
Internal view of tracing head showing phototubes, amplifier tube, light bulb, optical unit and steering-motor drive. Direction indicator is at top of the tracing head

considerable machining of the cut piece. This disadvantage is particularly evident when inside and outside corners are encountered.

Low-cost templet preparation cannot be stressed too strongly as one of the most important economic factors in shape-cutting operations. Drawings or silhouettes used as templets for electronic-tracing equipment are easily prepared by a variety of methods from paper, cardboard or plastic material. Black ink, or heavy pencil lines on white paper, silhouettes inked on a white background, or the paper-doll method of mounting the design cut from black paper on a white background, are methods which have produced excellent results. Although the black-on-white combination or vice versa is recommended, any color combination can be used which gives sufficient light contrast.

The cost of preparing drawings and silhouettes is exceptionally low and still further economy is realized in simple storage requirements. Alterations can be made quickly, which is particularly important when small dimensional changes are made in a part. These drawings are easily lined up with the work.

Black smudges will, of course, destroy the light contrast necessary for true reproduction. Therefore drawings or silhouettes which are to be used more than a few times should be protected with a coat of clear lacquer or by cementing a thin sheet of transparent material over the surface. The tracing wheel does not track over the templet outline, except where it may intersect the outline. The contact surface of the tracer wheel is smooth and slightly crowned, minimizing wear or damage on the drawing.



Examples of silhouettes and simple outline drawings which replace conventional templets with electronic-tracing units

One of the features of this reproduction method is the lead-in line which, in the case of these drawings or silhouettes, can be a strip of black paper laid on the white background so the electronic eye follows it into the drawing outline. The strip is then removed as the cut progresses.

A new field of application has been opened through the introduction of electronically controlled machine production cutting by the "chain" method of reproduction made possible with this type of templet. A series of identical shapes are drawn on the templet and connected with a continuous line, making a series of flame cuts possible.

In plants where a great variety of special shape-cut pieces are made, the economy of this low-cost templet preparation is particularly important. Where cutting machines are also used for plant maintenance work, jigs nad fixtures may now be shape-cut economically and damaged machine parts duplicated with little effort.

The photoelectric cell or "electric eye" which captured the public's imagination in recent years through its ability automatically to open doors, turn on drinking fountains, and perform other tasks has been applied to a multitude of industrial problems—wherever control can be simplified or made fully automatic. Therefore, it is not surprising to find electronic control has been successfully used in the welding field as a means of controlling weld quality in machine-welding operations.

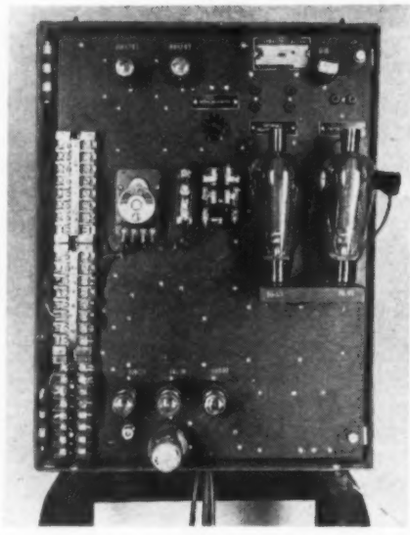
introduced to adapt all phases of steel shape-cutting to postwar production requirements, while at the same time assuring high quality and consistency of cut and materially decreasing the over-all cost per cut. Electronic-tracing equipment makes possible greater cutting accuracy without mechanical aids or human assistance previously required merely by following the outline of a drawing or silhouette of the desired pattern with extreme accuracy whether for 1 or 1000 cuts.

This equipment consists of two units—the tracing head and a control box. The tracing head is a self-contained unit replacing the manual or magnetic device and is attached in the same manner to the bar on standard pantograph-type machines. No modifications or alterations to the machine are necessary. This method of torch control is fully electric, and all parts of the tracing head such as motors, switches, electronic circuit and optical system, are completely inclosed. Electronic tubes are designed for long life.

Control of the Head

Operation of the tracing head is controlled by light emitted from the base of the head which is reflected back from the drawing and picked up by phototubes. This light is projected on the drawing in the form of a spot through lenses in the optical unit and is slightly deflected by a prism in the bottom of the unit. This deflection permits freedom of movement which allows the light spot continually to seek to position itself, half on the black line of the drawing and half on the white background, and enables the tracing head to follow any curve or angle.

The intensity of this reflected light controls movement of the steering motor. For this reason the drawing or silhouette must be of a color contrasting to its background. Reflected light picked up by the phototubes produces an electric signal, the strength of which depends on the intensity of this reflected light. This signal is amplified to provide current which flows through the steering motor armature and causes its rotation. Thus, if the light spot is directed entirely on the black line of a drawing, much of this light is absorbed and a weak signal is produced which causes the steering motor to rotate both the optical system and tracer spindle in a counter-clockwise direction toward the white background until equilibrium has been restored. Should the light spot be directed entirely on the white background, a strong signal is produced by the intensity of the reflected light which turns the optical unit and steering motor clockwise until the correct balance of light has been restored.



Control box with cover removed reveals the thyraton and amplifier tubes and electronic circuit arrangement

An example of the chain method of cutting is illustrated in this silhouette. The operation is continuous when several cuts are required, eliminating independent stops and starts

When the tracing head is following a straight line during a cutting operation, the light spot remains centered half on the black line and half on the white background. Through the electronic circuit, the steering motor is so adjusted that when this condition exists, no rotation of the steering motor armature takes place. The optical unit is free to rotate about its center in the same manner in which the tracing device rotates. Both the optical unit and tracing device are connected to the steering motor through a worm-gear drive so the units rotate simultaneously an equal amount in the same direction.

When a curved line is traced, the light spot transmits a constant slight or strong signal depending on the direction of the curve, so the tracing head follows the curve evenly with the aid of an anti-hunt device, producing a smooth cut. In this manner, the tracing head can continue to follow around a complete circle.

Cumulative errors caused by slipping of the driving wheel which are prevalent in other methods of torch control have been eliminated as the electronic tracing head constantly compares torch position directly with the drawing. The fact that this control provides a smooth, even, corrective action as the spot tends to vary from its correct position instead of full on or off control assures correction which is proportional to the amount of error.

Although the electronic tracing head has a speed range of from 2 to 30 in. per min., actual cutting speed for a given thickness of steel with electronically controlled machines corresponds to the speed of machines equipped with conventional tracing devices. The speed is set before the start of the operation and remains constant throughout the cut regardless of the design contour.

Accuracy of Tracing

The accuracy of tracing with electronic tracing equipment is within a few thousandths of an inch. During a test, the tracer head automatically traced over a drawing of a rectangular design for several continuous hours, using a scriber instead of a torch to scribe a line on a chalked plate. No appreciable change in the width of the scribed line could be observed. No difference in measurement between the drawing and the scribed line could be detected and extremely difficult and intricate corners presented no tracing problems.

Thus, electronically-controlled steel cutting may be summarized as possessing flexibility, accuracy, economy and quality far superior to conventional methods of guiding torches when intricate shapes—many of which are impossible to cut with conventional tracing devices—are cut to dimension with this fully automatic tracing equipment. Rapid manual movement from point-to-point to facilitate lining up the drawing with the material to be cut is assured through control switches. Low cost and ease of drawing or silhouette preparation make possible quick reproduction of complex designs while reducing operator fatigue.

WAGE INCENTIVES

What They Are . . .

How They Work . . .

Why They Are Effective . . .

Wage incentives are a prime means of doing three things: increasing workers' earnings, securing greater productivity and lower costs, and keeping down prices to the consumer. Because there is no more important subject to metalworking management today, AMERICAN MACHINIST editors have compiled for you this report on wage incentive plans. Eager to get it to you quickly, they combed the country from coast to coast for data by personal calls, telegraph and long-distance telephone.

★ AN AMERICAN MACHINIST REPORT TO THE METALWORKING INDUSTRIES ★

Wage Incentives Mean Greater Production and Lower Costs for Management, Higher Income for Workers, and Lower Prices for Consumers

INDUSTRY today is searching more intensively than ever before for ways and means of reducing production costs. The reasons are obvious. Hourly wage rates have risen sharply during the war and are trending toward even higher levels. Concurrently with the increase in rates has come a laxity in productivity. Many manufacturers say that output per man has declined alarmingly; in some cases plant efficiency is reported not much more than 70% of the prewar standard.

To top the problem, the government is sitting on prices, asserting that industry must be content with a narrower profit margin or must squeeze out the same profit from increased operating efficiency.

America's most urgent need in the months ahead will be to produce goods of all kinds in great volume. Consumers are crying for products of every form and size. Foreign countries are asking for both capital and consumer goods. The best protection against inflation is high productivity; when supply begins to catch up with and perhaps exceeds demand, the most menacing inflationary threat will have faded out.

Productivity then is the key to the situation. Industry must get all the production possible at the lowest cost, at the same time adhering strictly to a high wage standard that gives workers plenty of purchasing power with which to buy goods. Manufacturers must achieve the desired productivity partly by getting more output per man.

The matter of how much a man produces can be determined by two factors. The first factor is the mechanical aid given him that enables him to turn out with the aid of machinery much more than he could hope to produce by hand. The second factor is his willingness to do a day's work for a day's pay and to do a job to the full extent of his ability. If he has some sort of incentive over and beyond his hourly rate, his output will be more than it otherwise would be, the company will profit from lower unit costs, and he will increase his own take-home pay—so everyone concerned gains.

Incentives Benefit Everyone

It is with the second of these two factors that we are here concerned. Incentives properly installed and administered in a factory will go a long way toward getting from workers the maximum productivity that management can reasonably expect. It offers more advantages than any other method yet devised to benefit everyone—management with greater production and lower costs, the worker with a higher income stemming from more output on his part, and the consumer from lower prices.

Incentives are not new. They have been used for many years. Ten years ago the National Industrial Conference Board made a study of 630 manufacturing companies employing 700,000 wage earners that indicated that 44% were being paid on the basis of incentive plans. The proportions had not shifted much from those arrived at in a previous study in 1924. Because a relatively few companies took advantage of incentives to exploit their workers, union opposition sprang up, and during a considerable period prior to World War II not much was heard about incentives. In some places the word itself was taboo. Nevertheless, the probability is that the number of companies using some kind of wage incentive plan increased rather than decreased between 1935 and 1940.

Then suddenly, after America entered the war, the government put the spotlight on incentive systems. The nation was becoming desperate for manpower, what with the prodigal requirements of Selective Service and the needs of war production. Washington realized that it was imperative to improve efficiency in war plants, squeezing out more production per man. If output rose 20%, let us say, the over-all result was the same as though one-fifth more men had been added to the payrolls. Incentives quickly became a prime means of conserving manpower and stepping up war production.

The results were salubrious. The Management Consultant Division of the War Production Board said that the operation of new wage incentive plans "indicates that, on the average, an increase in production per manhour of about 40% occurred in the first ninety days of operation. Wages increased an average of 15% to 20% and costs decreased 10% to 15%." J. W. Nickerson, director of the WPB division, reported that "wage incentive plans applying to individual workers and based upon time study are resulting in increases in productivity of over 60%."

Summarizing the opinions of government officials, J. A. Krug, chairman of the War Production Board, flatly stated in April, 1945, that "the use of wage incentive plans,

14 GUIDING PRINCIPLES FOR WAGE INCENTIVES

1. The plan should be simple and should be easily understood by employees.

2. It should have the continuous attention of top management.

3. It should provide a fair minimum guaranteed wage.

4. Production as well as workers' pay should increase.

5. It should be based upon sound job standards arrived at by detailed time studies or the equivalent.

6. The production standard should be the amount of work performed per unit of time by a normal qualified operator under normal conditions.

7. Temporary standard should be held to a minimum and should be for short periods only.

8. Unit labor costs should go down.

9. The basic hourly rates that existed prior to the plan should ordinarily become guaranteed rates of pay under the plan.

10. Provision should be made for changing production standards whenever changes are required in methods, material or equipment.

11. Incentives for individuals and small groups are more effective than those for large groups.

12. Foremen should be trained to consider sympathetically complaints from employees as to alleged inconsistencies in individual incentive rates.

13. If indirect employees are included, indirect manhours should be correlated in some way with a measurable unit, such as total production or direct employee hours, so that indirect labor overhead costs may be kept under control.

14. The plan should be set up and operated so that no limit is put on the worker's income when he increases his output.

WHAT TO DO

Pay incentive premium with regular pay for incentive period. Otherwise reward is dissociated from effort in mind of worker.

•

Inform employees promptly of their efficiency rating.

•

Give special attention to plan for establishing rates of payment. Stick to whatever form you choose initially, as changes are hard to make.

•

Guarantee a minimum basic hourly rate not dependent upon productive efficiency.

•

Insure accurate counts of pieces that pass inspection.

•

Allow for unavoidable loss of time in fair but prudent manner and have definite procedure for such allowance.

•

Bear in mind that piece-rate plans work best when a close relationship exists between production and the effort and skill necessary.

•

Consider carefully control of indirect labor, especially if departmental or plant-wide incentive is applied.

•

Administer the plan as a progressive operation requiring continual analysis and adjustment.

•

Adjust to inventory of work-in-process where efficiency is materially affected by failure of production to reach counting or pay points. If this is not done, alternating periods of high and low efficiencies may result in increased unit costs.

applied through the cooperative effort of management and labor, has been one of the most effective, though one of the most undramatic, factors in making possible the fourfold increase in monthly war production. . . . I know of no technique of war production which has had greater simultaneous benefits upon munitions output and sound industrial relations than fair, just, and well-engineered wage incentive plans."

Mr. Krug concluded, "Looking ahead into the future peacetime period when America's industrial might must once more lead the world into an era of progress and plenty, I feel certain that our wartime experience with wage incentive plans will be a permanent benefit to our national economic life."

Though incentives had been associated with the discredited speedups in the minds of many union leaders, it is significant that almost half of 1972 plants with newly-installed systems reported to WPB that their plans were installed with whole-hearted acceptance by the unions in the plants. In fact, plans in plants having unions covered a greater number of workers than the plans for companies without unions.

WHAT INCENTIVES ARE

Wage incentives have been variously defined. They are "methods of paying workers in some degree for their effort, rather than of paying them on the basis of the time they spend at work," points out WPB. To put it another way, "an incentive is something designed to stimulate greater response in a certain direction through providing a reward, in this case a financial reward, for accomplishments better than a fair, reasonable norm or standard."

In short, each employee is given a chance to prove his worth. If he is better than his fellow worker, he benefits financially. If he loafs on the job, he gets less than his companion who works harder.

Incentives can be applied to individuals, small groups, large groups and entire plants. During the latter days of the war they were

encouraged on a plant-wide basis in numerous companies, and salutary results were observed. In general, however, this plan succeeds only when a plant makes one unchanged product over a long period. Incentives are much more easily and satisfactorily installed and operated when smaller groups are involved.

Two factors are to be considered in establishing incentive plans: first, the method of determining the base or standard or 100% productivity; and second, the amount of payment to be made for production below, at and above the base. The base, at times, has been arrived at by guess (which is the least desirable method), sometimes by records of past performance, and sometimes by time studies carefully worked out and backed up by fundamental research into methods, materials and equipment. The latter method is the best.

KINDS OF INCENTIVES

There are three basic groups of wage incentive plans:

1. Measured day work. The employee is paid an agreed-upon sum per hour or per day if he attains a minimum production standard that the management has set for the job.

2. Standard time or premium. A standard attainment is set for each operation. Betterment of the standard entitles the employee to a bonus on top of the standard rate for the operation. The term premium is applied to plans in which the savings are divided between employer and employee, or between direct and indirect labor.

3. Piece work. A fixed rate is set for each operation and the employee is paid this amount for each operation completed and accepted. By this method a man's pay increases directly with an increase in his production.

Several kinds of piece-rate incentive systems are being used, in addition to the straight piece rate based on the quantity produced. The Taylor differential piece rate, for instance, establishes two piece rates, one for production below standard and the other for the employee's production when it equals or ex-

WHAT NOT TO DO

Do not think that wage incentives are a substitute for good management.

•

Do not install incentives until proper standards can be set up.

•

Do not use a wage incentive plan as a means for supporting low level of basic pay.

•

Do not establish incentives as a subterfuge to avoid plant-wide general increases.

•

Do not pay a premium for unmeasured effort in order to maintain past earned incentive rates. Such procedure is unequitable and unsound, tending to destroy the incentive plan itself.

•

Do not compensate a man at maximum incentive pay merely because he has done all that he can do on his own job.

•

Do not pay on a departmental basis if operations in a department involve parts not common to all employees.

•

Do not pay all or a portion of the indirect workers a bonus equivalent to bonus earned by group of direct workers without any measure of productivity of indirect workers. Otherwise extra compensation is uncontrolled increase in pay and destroys value of direct workers' incentive.

ceeds the specified plant standard.

The Merrick multiple piece-rate plan establishes three different piece rates instead of two, as in the Taylor plan. The first is for sub-standard work and usually applies to beginners. The second also is for substandard work, but the substandard is only a little below the standard task set for the job. The third is above standard.

The Halsey premium plan establishes production standards based on performance the past few months and shares the time saved between the company and the employee. A proportion of all time saved is paid the employee at his regular hourly rate, the remainder of the savings being kept by the company. If the employee fails to complete a job in the allowed time, he receives his hourly rate. In some cases a portion of the company's share of the savings is allotted as a bonus to the foreman. This plan is applicable to jobs infrequently repeated.

Under the Emerson plan earnings are divided into three steps. The first is a guaranteed daily wage up to 67% of the standard task, the second is a gradually increasing bonus for production from 67% to 100% of the standard task, and the third is equivalent to a high step piece rate consisting of an additional 1% bonus for each percentage of increase in production above the standard task. This plan can be easily combined with hourly rates when it is necessary to shift from one to the other and is regarded as advantageous for the beginner.

Some Use Point System

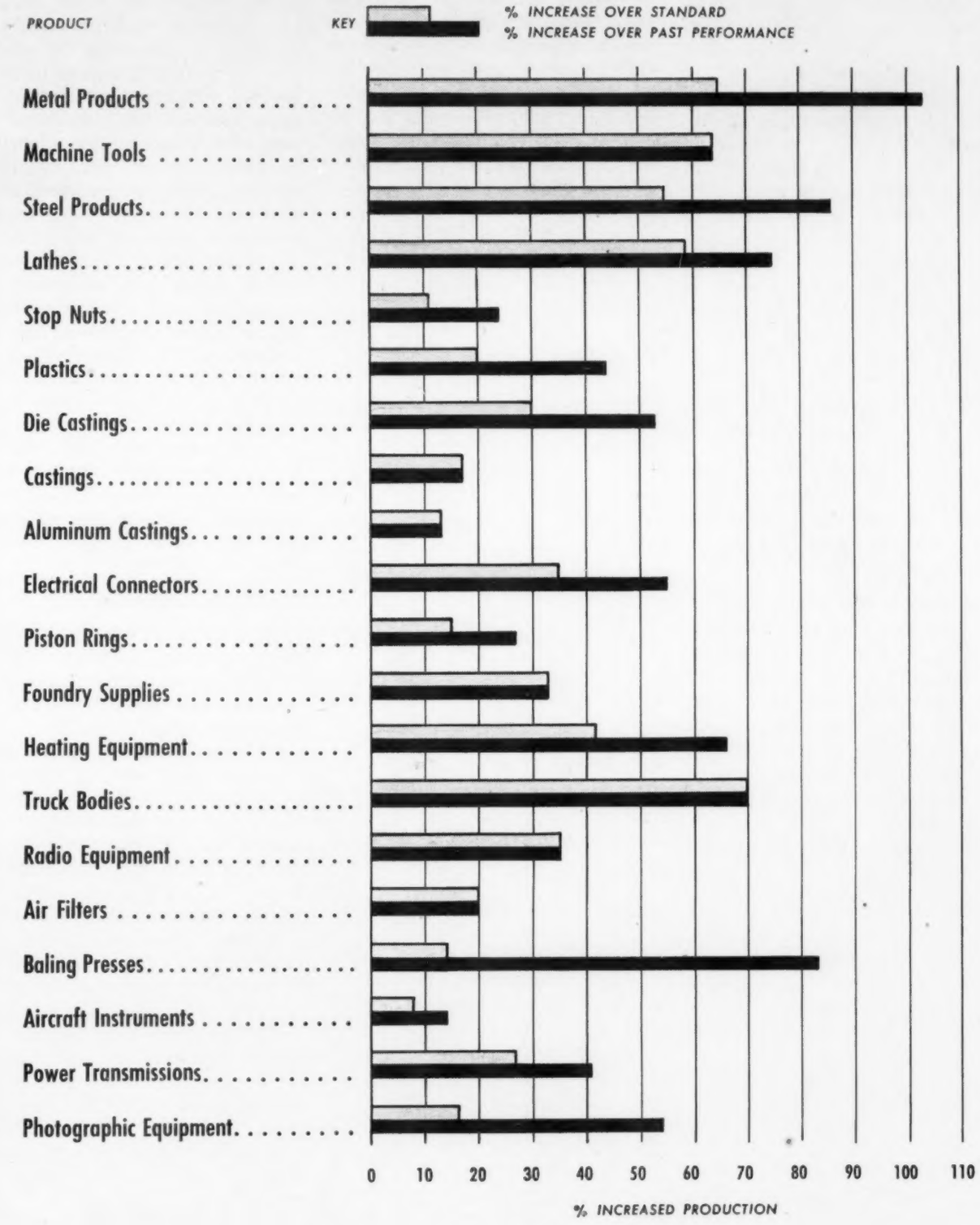
The point or unit incentive system uses a point as a unit of measurement. A point is the amount of work an operator can do in one minute of time. A point standard (the number of points set as standard performance for a given operation) is established for each operation by time-study analysis. In the Bedeaux point system the unit of measurement is called the "B," in the Haynes Manit system it is termed the "manit," and in the Dyer system it is the "unit." Employees' earnings are determined by the number of "B's," "manits" or "units" completed. In all three systems the operator is paid a minimum hourly rate for all work up to the 60-point standard. When the operator exceeds the 60-point standard he is paid a certain percentage of the time saved.

At one time the Bedeaux, Haynes Manit and Dyer systems were premium plans. Savings were divided between the direct labor, and the supervision and indirect labor. In the Bedeaux plan 75% of the savings went to direct labor and 25% to supervision and indirect labor. The Haynes Manit and Dyer plans were similar except that a larger percentage of savings was apportioned to direct labor. Though some companies still are using these plans as outlined, more recently the systems introduced by companies just adopting incentives provide for giving all the time saved to direct operators. If the supervisors or indirect labor are paid a bonus, the funds come from the company's savings from reduced unit costs and waste reduction. The chief differences between the three systems are in the methods for establishing standards and in the reports for controlling operations and costs.

Measured day work is a modified form of fixed rate per unit of time. Standards and rates are set up in much the same manner as for other wage payment plans. In arriving at rates, one should put emphasis on such values as quality, service, dependability and versatility as well as productivity. Groups of points are utilized in evaluating rates. A certain number of basic points usually represents the routine part of the task and others cover such fea-

Piece rates should be based on normal performance of a normal, qualified operator working under normal conditions. The standards should be set by a standards department or by competent industrial engineers

ACCOMPLISHMENTS OF INDIVIDUAL INCENTIVE PLANS



tures as mentality necessary, skill required, responsibility involved, physical application required, working conditions, value of materials worked on, and effort necessary. The relative weight of the features will vary in different industries and in different parts of the same industry. Ratio values are often established from the combined judgment of the supervisors, foremen and the standards department.

After careful study the Wilcox-Rich Division of the Eaton Manufacturing Company recommends that incentives be developed in the following steps: 1. Straight day work; 2. Measured day work; 3. Plant-wide or department bonus; 4. Small group bonus; 5. Individual piece work. Straight day work is put at the head of the list because it requires no experience. Individual piece work is the last step, since it takes maximum ability and efficiency on the part of the management. Wilcox-Rich points out that "it is not nearly so hard to establish an incentive plan as it is to administer it properly. Unless management is prepared to expend the necessary effort, adopting a plan is useless."

When Piece Rates Work Best

In considering the kind of incentive plan to adopt, one should pay attention to the fact that straight piece-rate or tonnage-rate plans work best when there is a close relationship between production and the effort and skill necessary. In some plant operations no such relationship exists. In such instances, some other measure of effort should be employed.

As one expert consultant says: "Incentives should promote good utilization of manpower in every direction, including skill, quality and service as well as quantity. This means that in addition to promoting good productive use of individual physical capacity, they should also promote skillful use of mental qualifications to secure better utilization of equipment, of materials, of supplies, of space, and of increased quality. Whether directed toward greater physical or greater mental productivity, all contribute to low costs and better wages."

INCENTIVES FOR INDIRECT WORKERS

Incentives can be paid to indirect as well as direct workers. Many companies are doing it. The best course for the manufacturer to take if he wishes to apply incentives to indirect workers is to determine the specific functions of these workers and the time allowances necessary for their performance. Sometimes this can be done as readily as for direct workers. If some form of incentives is to be applied to indirect workers as a whole, or in groups, a bonus depending only on the production per manhour or the efficiency of the direct workers should not be used unless there is a direct relationship between the two kinds of work. Such a bonus without such a relationship represents an uncontrolled increase of pay and tends to destroy the value of the direct workers' incentive.

The important principle in applying incentives to indirect workers is that a direct relationship be established between the standards used to determine the amount of the incentive and the output of the indirect workers themselves. If indirect workers should receive an extra bonus simply because some other group earned a bonus, and without a corresponding increase in their own production, the incentive for increased output is lost. One should remember that inclusion of indirect workers is a potent factor in eliminating delays of all kinds in a department and in a plant.

Scope Should Be Defined

"The most important single prerequisite for indirect incentives," states C. T. Dunn, vice president of Albert Ramond & Associates, Inc., "is a suitable management-labor relationship and policy on production problems. No better premise can exist than the simple statement 'a fair day's work for a fair day's pay,' and its corollary 'extra pay in proportion to effort beyond a fair day's work.' It is essential that the scope of incentives be clearly defined in writing so that base wage problems will always be treated as such, and incentive earnings will always be considered as an extra, earned by the special efforts of the workers."

Incentives should be installed only with competent technical guidance. The standards (or time study) department should have a highly trained staff. If such personnel is not available, the setting of work standards should be delegated to competent industrial engineers. Standards are based on normal performance of a normal, qualified operator working under normal conditions. A normal, qualified operator is one who possesses and applies sufficient skill to do the work and exerts reasonable effort commensurate with the guaranteed base rate of pay. The normal operator is not necessarily the average operator, for the latter may be better or poorer than the normal under varying conditions. The term, standard, is the unit of measure of work output. Standards apply to work done in either direct or indirect labor operations. Indirect labor operations often can be reclassified as direct when proper measurements are set up.

Standards Desirable

The Automotive Council for War Production was authority for the statement some months ago that in every known case in which a plant has changed from straight day work directly to a full-scale individual incentive plan without standards, earned rates of pay have proved to be out of line with the skill involved, both on the high side and the low side. Attempts then to adjust rates by cutting those of lower-skilled jobs to bring them into proper relationship with the higher-skilled jobs have been resisted by employees. Rate disparities, on the other hand, cause friction between employees, and between employees and the management; there is no surer way of dissolving quickly an incentives program and creating long-time opposition by workers toward any attempt at reinstallation of this or another incentive plan.

No incentive plan can succeed unless employees are sold on it. No

single factor is so important as to secure the backing of the men who are to participate. In many cases this is no easy assignment, because many unions have in the past been solidly opposed to incentive systems in general. Labor's distrust has sprung largely from three sources: The first is that some incentive systems were used as means for supporting low basic pay. The second is the belief, more prevalent in peacetime than in wartime, that increased productivity, whether the result of incentives or anything else, may mean the loss of jobs. The third reason is the instances of unfair or abusive incentive practices. Though these instances are few in number, they do great harm to the system in general. During the war, WPB was eminently successful in inducing labor to approve of incentives. The best way to sell incentives to employees is to work out a direct financial incentive so that the worker can see for himself a close relationship between his own contribution to production and his pay.

PLANT-WIDE INCENTIVES

Incentive plans embracing over-all plant coverage can lead to much trouble unless carefully handled. Such plans provide for payment to the entire group of a prorated share of a computed bonus accruing from any production over the base set. In most cases standards are established on the basis of past performance, which may have included inefficiencies and may not have indicated what production should have been turned out with the total manpower at hand. Moreover, in plant-wide incentives, no relation exists between work done by an individual and the increased earnings that he gets automatically, consequently there is a growing tendency to look upon the higher earnings as assured wages (which they are not). Over-all plans are apt to be unfair because of the relatively large amount of indirect labor involved, irrespective of the total output.

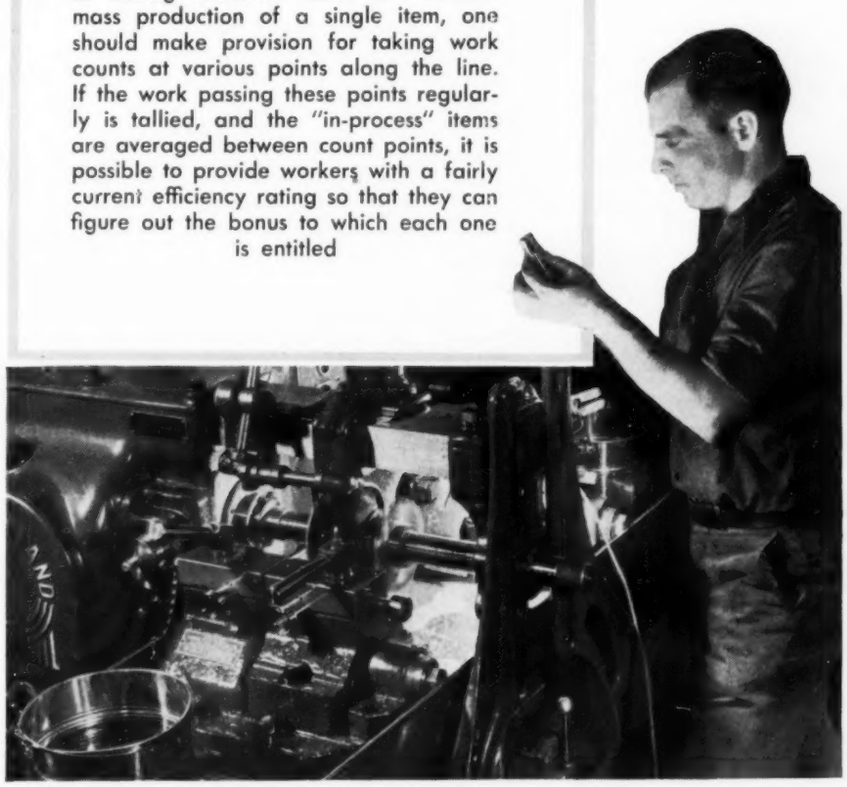
Factors For Success

An incentive plan should be administered as a progressive operation that requires continual analysis and adjustment. It should constantly have the attention of top management; it cannot be put in a niche all its own and forgotten. Policies as to administration must be clearly written so that they are understood by everyone. It is particularly desirable to try to establish the plan on a basis of voluntary cooperation on the part of employees. The fact must be recognized that for incentives to produce results, output of the individual employee must not be restricted, and this provision must be agreed to by the union, if there is one.

It is desirable to have a good suggestion system in connection with the incentive plan. Any complaints should be investigated promptly by the management. Standards should be revised when improvements are made in equipment, materials, methods and quality to maintain consistency of opportunity to earn incentives. Standards expressed in time are preferable to those stated in money, the latter being affected by any changes made in the rates of pay.

"An incentive plan of wage payment," declared a report of a leading trade association, "properly installed and administered, should serve the best interests of all parties concerned, which in the final analysis means maximum pay for maximum production. Like any other plan, program or device, it may fail of its purpose if it is hastily adopted, improperly installed, carelessly administered, or basically unsuited for use in the individual plant in which it may be installed. An incentive plan that is not thoroughly understood may be destructive alike to harmony, morale and productive efficiency by causing doubts, fears, suspicions and mental confusion among the employees. It is obvious then that to be of maximum benefit to both employee and employer, the incentive plan used should meet the specific requirements of each company. The problems of returning to the employee a maximum wage and to the employer a minimum net labor cost, coupled with individual plant circumstances, ... all tend to make the selection of a proper incentive plan an important and difficult task."

In setting incentive rates for "in-line" mass production of a single item, one should make provision for taking work counts at various points along the line. If the work passing these points regularly is tallied, and the "in-process" items are averaged between count points, it is possible to provide workers with a fairly current efficiency rating so that they can figure out the bonus to which each one is entitled



PLANS OF 10 INDIVIDUAL COMPANIES

These are typical wage-incentive systems now in successful operation in a variety of American metalworking plants

Falk Corporation

The company established a standards department in 1937 which inaugurated and operated an incentives system. The system provides incentives to the worker on direct labor and to groups of workers on indirect labor. Direct labor that can be timed receives allowed time for all operations performed. The allowed time is actual time plus an incentive ranging from 15% to 25%. The resulting allowed time for each operation is given to the employee when he starts the job and a record is kept of the time he gains throughout the day. The time gained is then converted to premium earnings at the job rate, which is the midpoint of the job bracket established by job evaluation. This premium represents a substantial addition to the employee's earnings. No limit is set on the amount that may be earned.

Indirect labor has a more flexible setup. Usually each group is allowed a given number of hours in percentage relationship to the total shop hours. Premium gains fluctuate with changes in these percentage relationships.

Employee reaction to the incentives system has been increasingly favorable. This is attributable to a growing confidence that the system rewards the capable, willing worker.

Automotive Parts Maker

Machine work is on a straight piece-work basis, while assembly work is on a group bonus system. The base pay rate is set at levels equal to or above the average for such work in the local community. This rate is included in the union contract. The base rate or performance standard is guaranteed unless a change occurs in method, materials, machine or inspection standards. Standards are established by the time study department. Operators who dissent from a standard can file a grievance with the company. In case of a grievance, the management puts a demonstrator on the job under observation of time study engineers. If this "pace setter" cannot earn the base rate and a fairly good bonus, the rate is readjusted. The company's policy is to be reasonable in this respect. Men are not paid for parts spoiled due to negligence. Spoilage as a result of other causes is not charged against them. Since the company has had 25 years of production experience on the same product and is thoroughly familiar with machine speeds and feeds, the plan can be operated with a time study staff of one man for about every 350 to 400 employees. The present incentive system has been in use practically unchanged since 1923.

Lincoln Electric Company

This company's incentive system is based upon a bonus plan established in 1918 and improved in 1934. Piece rates are established for the various workers, and regular wages are paid on the basis of output. At the end of each year, workers are paid a bonus. The full amount of the company bonus is determined by the directors, but the specific bonus paid to each worker depends upon: (a) his piece-work rate during the year; (b) his length of service; (c) his general plant record. In recent years, the bonus has meant as much as 100% in addition to the base salary earned. The individual bonuses are set at the year-end by company president James F. Lincoln, based upon the stated factors.

Success of this plan is reflected by the company's ability to continually reduce costs, lift annual wages, and expand business (see chart). Low rate of absenteeism, small employee turnover, enthusiastic worker participation in the company's suggestion system, and a minimum of labor trouble are other benefits of the plan. The company has no union, and its president does not share in the year-end bonus payments.

Maker of Precision Metal Products

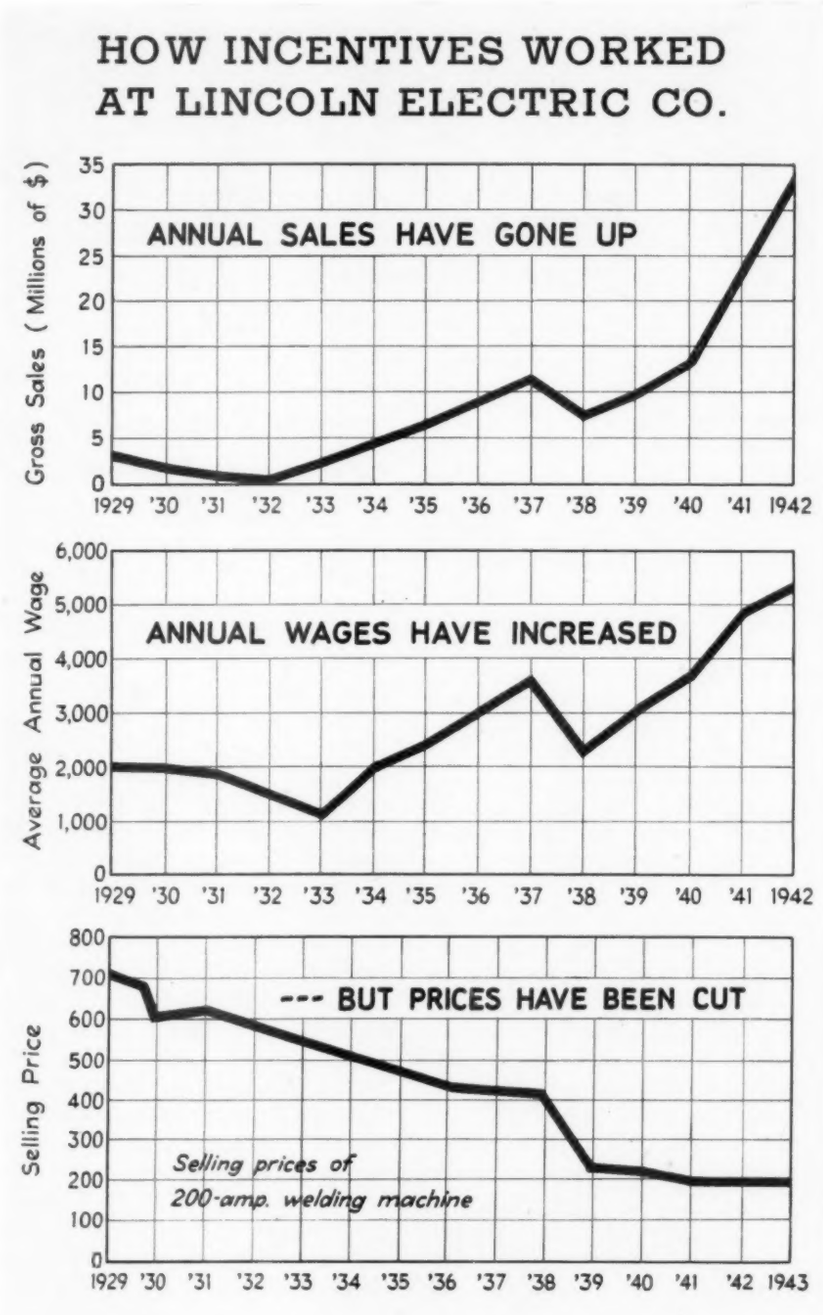
A straight piece-work plan is in operation, with rates set by time and motion studies and from other standard data. The standards are established so that the average operator possessing average skill and working with average effort will make a bonus of about 27% if he reaches the standard production rate. This company has tried various bonus systems, but they were mostly too difficult for the average worker to understand. It has gone back, under the circumstances, to the older piece-work method to make it easier for the production worker to calculate his earnings.

An Automobile Manufacturer

The incentive plan is based on both group piece rates and individ-

ual piece rates. The former apply principally to assembly-line operations. The group on the assembly line, for example, is paid so much per car assembled. The price paid is such that if the group meets its quota for the day, the earnings of each man will be slightly higher than his earnings based on a straight hourly basis. If for any reason—breakdown of conveyor system, shortage of parts, etc.—the line is stopped and the group cannot make up the time lost and meet the day's quota, each man is paid a straight hourly rate for the time lost.

Individual piece rates work out in much the same way as group piece rates. Each man is paid so much per piece produced and has a quota for the day sufficient to assure him slightly greater earnings if he meets the quota, than he would get on a straight hourly rate. The chief advantage of the plan is that it provides just enough incentive to keep operations moving at a steady and efficient tempo.



An Unnamed Metalworking Company

Motion study and standardization of operation followed by time study set the basis for the plan. Incentive base is calculated upon a "standard hour of work." This standard makes allowance for personal and fatigue time, and any other delays which may hamper the operation.

Standards are set at 80% of normal efficiency to allow operators an opportunity to make a 25% bonus with normal performance. In some cases, a 15% bonus opportunity is provided for normal operations by setting 87% of normal efficiency as the standard of operations.

Besides these direct work incentives, where such standards are not possible due to the nature of the work, indirect incentive plans have been set up predicated upon factors over which the employee has control. Supervisors are included under this indirect plan. Although control and results of the indirect incentive plans are not as effective as those achieved from direct bonus, they have maintained and improved operating efficiency.

Most workers of this organization are under one of these incentive plans, and the management is seeking to extend coverage still further. Production has responded favorably to the incentive system. The incentive plan has been in use since 1928.

Thompson Products

Worker gets a guaranteed day rate, similar to prevailing rates paid in the community for similar work, and in addition incentives are paid. Bonuses are paid for extra production above the normal standard requirements, determined by time study.

Allowances for scrap are made, up to which employees are not penalized. Such allowances are based upon the average experience for the particular operation. If workers keep scrap below the minimum allowance, then their bonus increases. Personal time allowance of 11.1% a day is made to give workers rest periods.

In group work, the production of all workers is combined, and all of them share in the increased productivity of the group. Group workers can find out what their

RESULTS OF INCENTIVE PLANS...

1 USING TIME STUDY METHODS

PRODUCT	INCREASED PRODUCTION % Over Standard	% Over Past Performance
Individual Incentives		
Stop-nuts	11	24
Plastics	20	44
Steel Products	55	86
Baling Presses	14	83
Machine Tools	64	64
Metal Products	65	103
Group Incentives		
Aircraft Instruments	8	14
Photographic Equipment	16	54
Power Transmissions	27	41

2 USING PAST PERFORMANCE AS BASIS

PRODUCT	INCREASED PRODUCTION % Over Standard	% Over Past Performance
Individual Incentives		
Electrical Connectors	35	55
Die Castings	30	53
Piston Rings	15	27
Group Incentives		
Castings	17	17
Foundry Supplies	33	33
Heating Equipment	42	66
Truck Bodies	70	70
Radio Equipment	35	35
Air Filters	20	20
Aluminum Castings	13	13
Plant-wide Incentives		
Lathes	59	75

daily efficiency is, and how much pay to expect.

A Farm Equipment Producer

Company uses the "Manchester" system, which is based upon piecework with a guaranteed hourly rate set at a level about 20% below the hourly incentive rate. Workers suffering from reduced earnings as a result of conditions beyond their control are compensated in several ways: (a) allowances for delays in production caused by lack of work and similar factors, are paid for at the guaranteed hourly rate; (b) delays caused by abnormal conditions, such as equipment difficulties, are allowed for at the workers average earned rate; (c) special work performed by the worker outside of the regular rated work is paid for at the average earned rate.

All jobs are carefully evaluated to keep compensation rates for different production operations in line with other operations in the same plant, and in line with similar operations in other plants. This is regarded by the management as being a vital factor in the setting of piece rates to aid worker incentive.

Plomb Tool Co.

Time standards are all set by time study and are then guaranteed against change, as long as production methods remain the same. If method is changed a new time study is made, and the new standard is announced before its effective date. Standards are sufficiently conservative so that most workers can earn about one-third over base pay. Bonuses are paid weekly, with the regular base pay. Each day the record of each employee is posted for the previous day, so that workers may constantly know where they stand.

Overtime rate is 1½ times straight or base pay plus the bonus earned during the first eight hours of the day (plant operates on a 10-hour-day basis. The hourly piece rate bonus during overtime remains the same as during the first eight hours, with the base rate being increased 1½ times.

Breakdown time is not charged against production time rates, being deducted before calculating the bonus rate. However, the base rate is paid for down time. Set-up time is virtually standardized on all jobs at two hours. If done in less time, the saving is added as bonus units.

Automotive Parts Company

An automotive parts maker has set incentives with the understanding that standards would not be changed, and increased productivity would go entirely to workers in the form of higher wages. The more they produced, the higher their incomes in direct ratio. Increased pay is calculated on the basis of the combined production of all individuals in a given group. Results have been a steady 25% increase in production.

Murray selected five union men, trained them in time study for six months at the company's expense, and these men are available to "check" any standard set by the company in the event any questions are raised by the workers. With both sides agreeing on the standards, the union binds itself in its contract with the company, as follows: "Continued failure of an employee to produce on the basis of agreed standards will be considered due cause for discipline." Such discipline can mean discharge, where necessary.

TALKING SHOP

Refilling Prohibited—It Says

NOW THAT THE war is over, Coca Cola bottles and Shinola boxes will again have international implications. You may remember the story of the Jap delegation of engineers which took copious notes of methods in an American machine-tool plant. Among other things, they carefully noted the Shinola boxes (or was it Bixby's or 2-in-1?) in which the boys kept individual supplies of abrasive grain. Shortly thereafter, the shoe-paste company got the biggest Jap order of its career. And sometime later, an even bigger complaint. The Shinola wasn't doing what the mission had seen it do in this country.

SIDE WORD to Mr. Moto: The stuff in new coke bottles doesn't lubricate machines either. It's just another dirty Yankee trick.

Salmagundi

IN "WHEELS IN HIS HEAD", a new Whittlesey House book, M. M. Musselman describes his father's invention of one of the early mechanics' soaps. It seems that the mechanics in A. J.'s motorcycle factory spurned the grease-cutting soap he supplied. Instead, they lathered with ordinary soap, then dipped their hands in sawdust. That cleaned off the grease without scouring their hands raw. So A. J. made all kinds of sawdust-and-soap mixtures, finally settling on extra-fine spruce dust and pulverized Castile soap, which he marketed as "Salmagundi." It never sold very well, but did the job. Must have been tough on drains.

"Secret" Abrasive

FRED COLVIN tells us that in 1907 or 1908, men at Acme Auto (Reading, Pa.) advised him they had a "very secret" abrasive that could be used in lapping pistons. The abrasive broke down in a few minutes—didn't even have to be washed out. It turned out to be Sapolio hand soap. Several years later he heard of such an abrasive at Ajax Motor (Indianapolis). It was Sapolio. At Indianapolis speedway, some years later, he heard of such an abrasive for lapping bearings as well as pistons. And in 1932 he heard of one at Hall Planetary for lapping milling-machine spindles. They were "very secret" too. You guessed it, Sapolio again.

Sequence

HENRY FORD II, president, Ford Motor Company, was recently quoted as saying, "When there is NO PRODUCTION, there are NO SALES-NO INCOME-NO JOBS."

Jig or Fixture?

POOR OLD ENGLISH takes a beating in more ways than one, particularly among us slangy Americans. We have so many picturesque synonyms that we lose the basic words, depend so much on inflections and context that the words themselves often mean little. Once "bulldozer" meant only a special make of horizontal crankpress; now it is anything big and powerful, including the Seabees' scraper-bladed tractor that topped tanks and planes for priority not so long ago. Our plaint today, however, is generated by those words arbor, mandrel, jig and fixture. You'd never guess from current usage, but an arbor holds the tool, a mandrel holds work (except on grinding bobs, where "mandrel" seems firmly entrenched). Further, a fixture holds work, a jig also guides the tool, making all jigs fixtures, but not all fixtures jigs. Mass production of airplanes messed the latter pair up, what with drill plates and overnight-transmuted production men. Everything there was a jig. Sort of hurts our professional pride, like having the doctor say "cold" instead of "coryza."

Atomic "Secret"

PLUTONIUM was shipped west from Oak Ridge, Tenn., in small packages carried by messengers riding Pullmans. For greater secrecy, no messenger made the trip twice, and no two were acquainted. One morning the porter said to one messenger, "Boss, you'all am from Oak Ridge, ain't yo'? They's 'nothuh man in Section 5 from Oak Ridge too!" Both men stoutly denied it. To which the porter replied: "You'all cain't fool me—ah knows dat Oak Ridge red clay on yore shoes. Been seein' lots of it lately. Cain't miss dat red!" Which probably caused a similar color on faces at G-2.

Helical Staircase

AMONG WORDS frequently mixed are "spiral" and "helical." Only a clock spring is a spiral—a coil in *one plane*. The coil spring, whether it is a cylinder or a cone, is a helix. All thread forms are helices. We'll never be able to convince the world that a spiral staircase is really a helical staircase (even Webster gets all tangled up in the attempt to explain) —but we thought you'd like to know about it.

P. H. E. W.

A GROUP OF technical editors recently had the opportunity of taking the excellent G.E. slide film course in industrial electronics. They attended class faithfully one day each week for twelve weeks increasing their store of knowledge in this new science. On the last day it was thought fitting to mark the commencement exercises with a permanent sign of the pupils' achievement. So each was given a diploma, suitably inscribed with his name and conferring on him the degree, Profound Harbinger of an Electronic World, with the privilege of using the initials after his name.

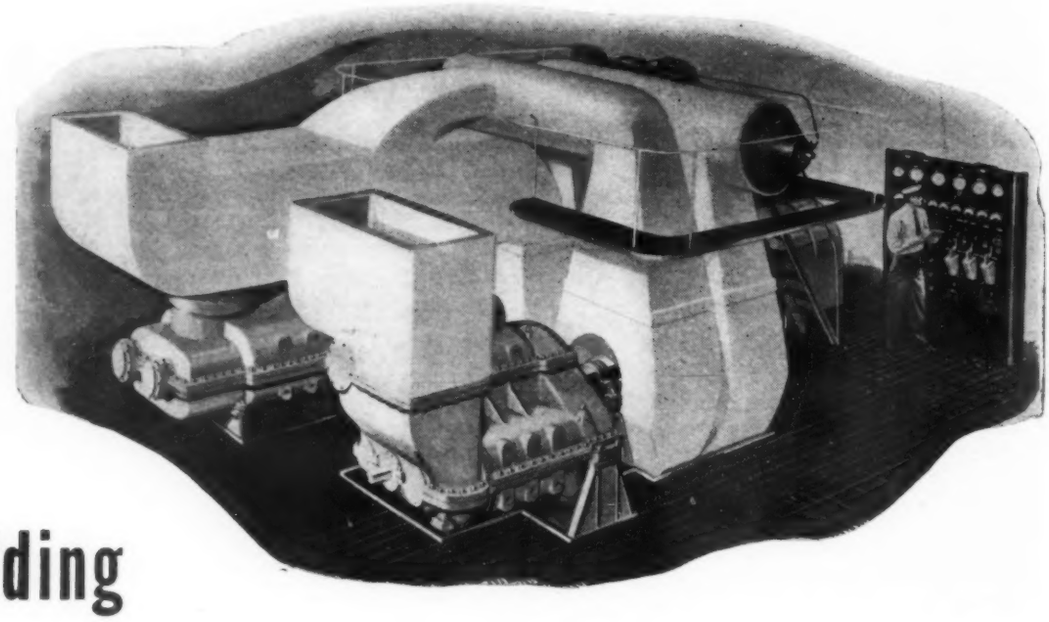


Fig. 1—Proposed arrangement of the Elliott gas turbine for marine service. The control board at right provides for centralized operation by one man

Arc Welding Assembles the Elliott Gas Turbine

This newcomer to the field of prime movers depends upon heat-resisting materials that must be joined into stable units despite complex welding problems

THROUGH DESIGN ACHIEVEMENTS and the availability of modern materials and fabricating methods, the long-heralded gas turbine is apparently destined to become one of the principal types of prime movers. An American type, the Elliott, was recently tested successfully at Jeannette, Pa. This 2500-hp. power plant, designed for marine service, burns oil and is more efficient than a steam plant of similar capacity.

Materials play an important part in making possible the operation of the gas turbine at the extremely high temperatures involved. The Elliott gas turbine consists of eight major parts, Fig. 2: two turbines, two compressors, two combustion chambers and two heat exchangers. At full load operation, air enters the low-pressure compressor and is compressed to approximately 43 psia. and 300 F. After passing through an intercooler the air enters the high-pressure compressor, which raises the pressure to 96 psia. and is heated by the exhaust gas in a tubular regenerator before entering the combustion chamber. Fuel oil is burned directly in the air stream to bring the temperature to 1230 F. at the entrance to the high-pressure turbine. Expansion in the turbine to 53 psia. develops sufficient power to drive the low-pressure compressor. Additional oil is burned in the low-pressure combustion chamber to reheat to 1207 F. Expansion to slightly above atmosphere in the low-pressure

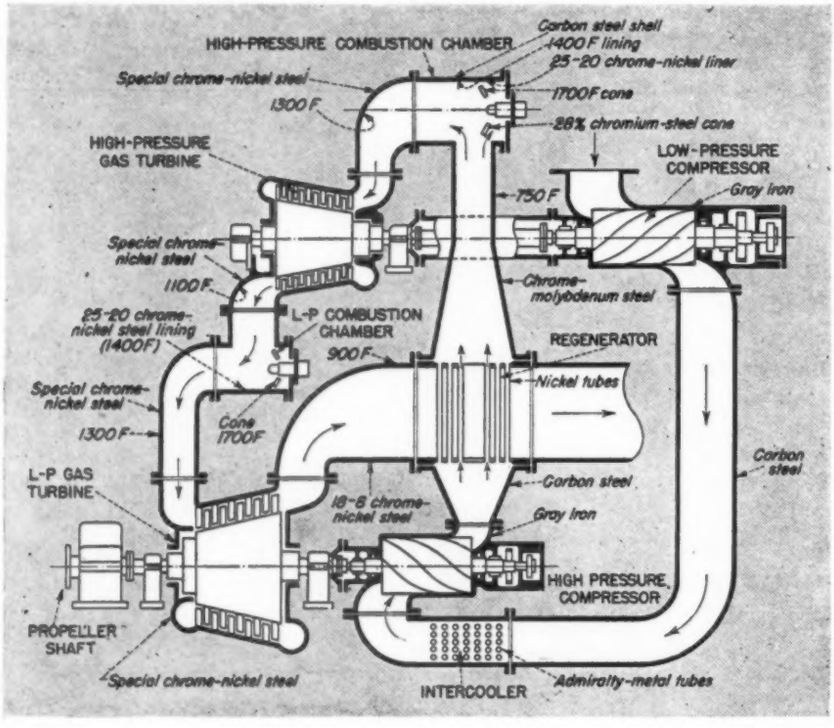


Fig. 2—Special materials are required in the eight major parts of the Elliott gas turbine in order to resist the high temperatures and stresses encountered in service

turbine develops 5000 hp. Of this power output, 2500 hp. is net for useful purposes, the remaining half is consumed by the apparatus.

According to information supplied to the Lincoln Electric Company by J. F. Cunningham, Jr., engineer in the Manufacturing Division, Research and Development Department, The Elliott Company, the gas turbine could not have been built successfully without turning to arc welding of certain vital assemblies. In applying arc welding to fabrication of the gas turbine, a number of complex problems had to be solved. Among these were joining special materials for high-temperature service and the welding of intricate parts.

Probably the most complicated welding operation in the entire fabricating procedure was the fusing of rotor disks to form a rotor assembly. In the first phase of this fabrication, the rotor disks were completely machined, the blades being attached and shrouded as shown in Fig. 4.

Next, the stub shaft for the inlet end of the rotor was arranged in a framework and the first disk heated in hot water and placed on the stub shaft. Pressure was applied to hold the disk tightly against the stub shaft during cooling. When cool, the disk was then shrunk securely in place. The same procedure was used to shrink each of the succeeding disks onto the rotor assembly.

With the rotor assembled in the vertical position, four tack welds were made in the welding groove of each joint to hold the parts together and apply tension in an axial direction. At this point, rollers were applied against the shaft to hold the rotor and the entire frame was laid on its side, placing the rotor in a horizontal position, Fig. 3, ready for finish welding.

The disks, which required welding

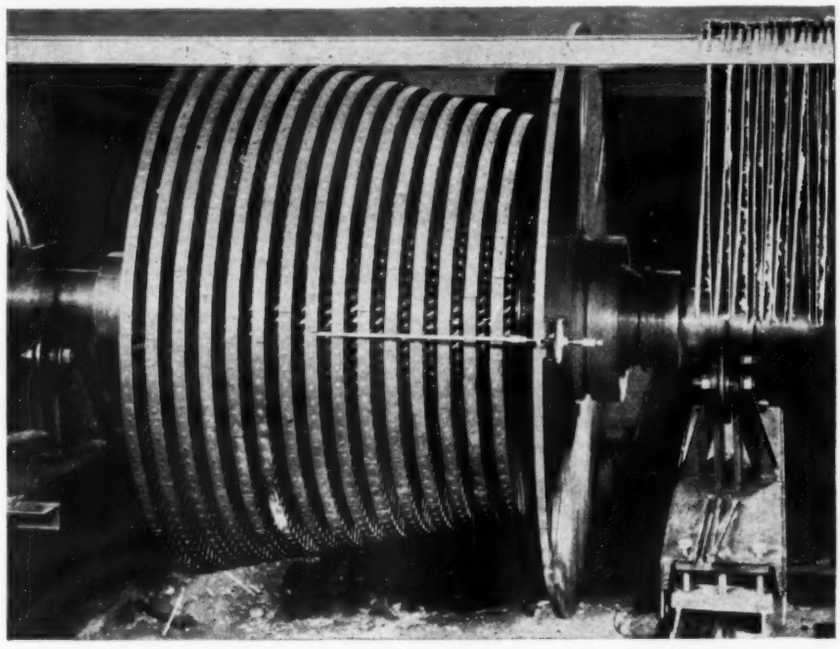


Fig. 3—After the rotor disks are shrunk upon the shaft, the assembly is placed on rolls of the balancing type to permit disks to be welded circumferentially

Fig. 4—Blades have been attached to the machined rotor disk and shrouded. Just above the vise jaw is a welding fillet. As sketched, a U-shaped welding groove is formed when two rotor disks are butted

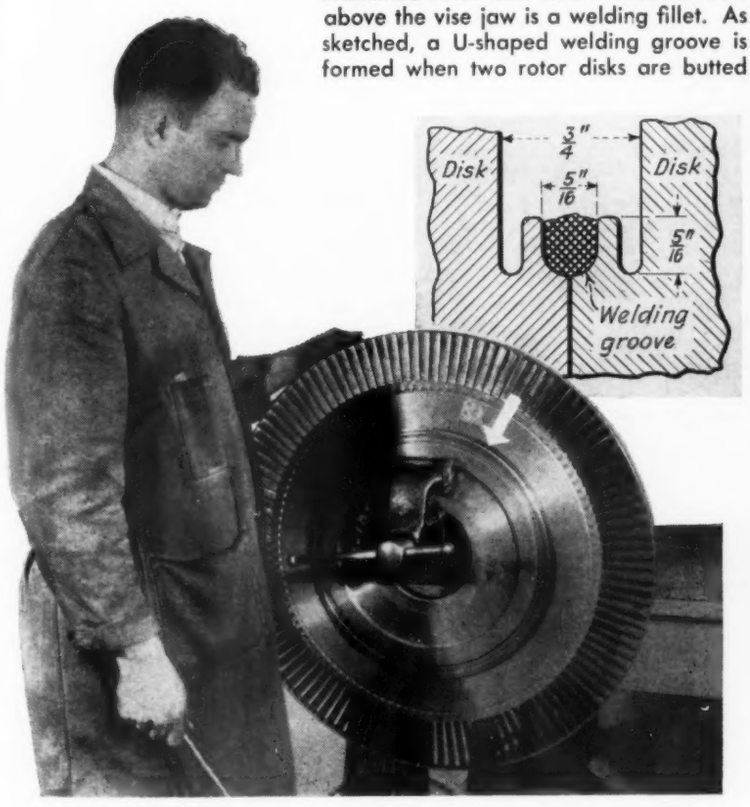


Fig. 5—To reach the weld location, it was necessary to weld a special electrode to a steel electrode. Shields prevent spatter upon the adjacent disks or blading

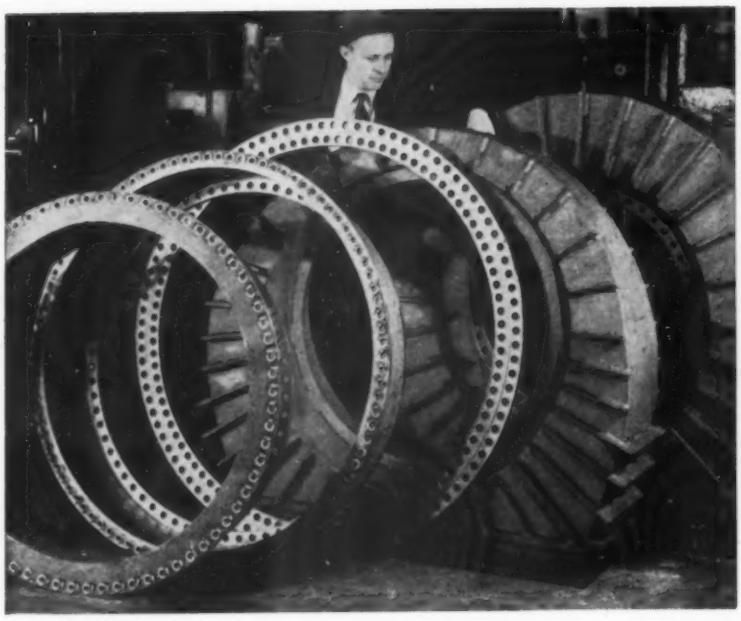


Fig. 6—Turbine ductwork requires considerable arc welding for assembly purposes. Skip welding provides ample strength and avoids distortion while saving weld metal

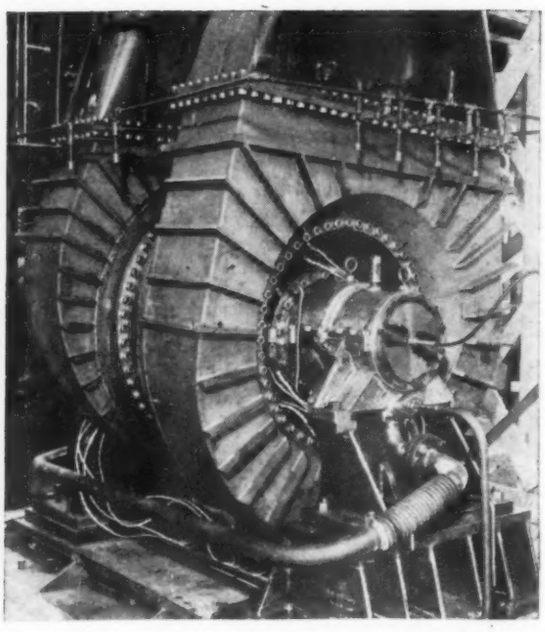


Fig. 7—Base supports at the exhaust end of the turbine unit are also arc-welded for both strength and lightness and gussets are added

to each other, were designed at the hub so they presented groove welding joints, as illustrated in the sketch, Fig. 4. Situated within the disks, these joints were not readily accessible, being approximately 11 in. from the perimeter.

To reach the joint, the welding electrode, developed exclusively for welding special austenitic stainless alloy known as 19-9 WMO, was welded to the end of a 12-in. steel rod material which served as an extension for reaching down between the ¾-in. spacing of the disks.

Guards Protect Blading

Before welding, thin metal guards coated with whitewash and asbestos were placed between the disks to protect the blading and accurately balanced disks from weld spatter. These guards were suspended from the frame and remained in a fixed position while the rotor, connected by a belt to a variable-speed drive, was rotated at a welding speed of approximately 10 in. per min. Fig. 5 shows this welding operation in progress.

Welding fumes collected in the confined area between the disks and tended to reduce visibility of the weld. This difficulty was overcome by positioning an electric fan at the side of the rotor to blow out the fumes as welding progressed.

Three to four passes were required to complete each weld. The first pass was made with ⅛-in. rod and the succeeding two to three passes were made with 5/32-in. rod. To avoid distortion, welding was carried out to a pre-arranged sequence indicated on a calendar, each weld being checked off as it was applied.

After welding, the rotor was removed from the frame and placed in a furnace where it was rotated at slow speed and heated to 1,400 F. This temperature was maintained for 16 hr., then the rotor was allowed to cool. Some rough machining was done on the assembly before it was returned to the furnace for "heat indication." This process was carried out to eliminate possible occurrence of the phenomenon which may cause rotors to bend at high temperatures and return to normal when cooled. As rotors must retain their perfect balance when subjected to high temperatures as well as when cold, they must be heat indicated. This involves placing the unit in a furnace and increasing the temperature gradually while the assembly is rotated. As temperature increases, the amount of bending in the rotor is gaged by measuring the eccentricity, using dial indicators.

When the rotor reaches the point where there is no increase in bending with increase in temperature, it is considered stable. Upon completion of heat indication, the stub shafts of the rotor are finish-machined and the assembly is ready for installation in the turbine.

The extensive duct system for the Elliott gas-turbine power plant offered another challenge which was successfully met by welded construction. Individual duct assemblies were fabricated of saw-cut material ranging in thickness from 3/16 to ¼ in. with $1 \times 1\frac{1}{2}$-in. main flanges and $\frac{1}{2} \times 2$ in. stiffeners. All parts, including the inside cast circular flanges, are of the same 19-9 WMO, heat-resisting material. Parts comprising a typical ductwork assembly unit are shown in Fig. 6.

The duct system, which is designed to handle up to 80 psi., is butt and corner welded at the joints in two passes. The entire duct system is constructed to be free-floating from the bearings, thus preventing transmission of vibration to the structures. Intermittent or skip welding predominates, this technique being utilized to reduce effective shrinking force and minimize the amount of weld metal applied, yet retain the required structural strength. The entire duct system includes both inlet and exhaust manifolds of the power plant.

Further arc welding is shown in the design of the supporting structures which anchor the plant. These base members, which are solid butt and fillet welded into integral units, are bolted to the concrete floor. Fig. 7 showing the exhaust end of the turbine, also illustrates the welded base design as shown at right, foreground. These supporting structures are of heavy steel plate ranging up to 1½ in. in thickness with ½-in. and ⅝-in. gussets welded in at critical stress points.

INCENTIVES FURNISH THE DRIVE

THE COMING YEAR, 1946, and the years to follow can bring unprecedented prosperity to the people of the United States if the incentives to secure it are provided.

We have the advantage of starting with an economy which has demonstrated a capacity for expansion unequalled in any other country in the world. Our economy has demonstrated, also, one grave weakness—a recurring interruption of the upward trend of production and living standards by wasteful and paralyzing periods of recession. Recovery from each depression always has carried us to new heights of economic welfare, but the toll of the years of blight has been harmful to everyone.

The job ahead of us is a dual one. We must maintain the vitality of an economy which, over the years, has yielded an enormous increase in the American standard of living, and we also must improve its stability.

The Dynamics of American Production

In the last prewar year, 1940, the population of the United States was 3⅓ times as large as it was in 1870. But the national production, measured in dollars of constant purchasing power, was 10 times as large at the end of the period, and industrial output had increased 20-fold.

In the meantime, the average number of hours of factory workers had been reduced from about 63 per week in 1870 to less than 40 in 1940, while average hourly earnings had more than trebled in dollars of constant purchasing power. Thus "real" weekly or annual wages in manufacturing had doubled over the 70-year period, even though the work-week was cut by 35 per cent. This was made possible chiefly by a tremendous increase in the quantity and quality of the mechanical facilities which were provided in American manufacturing industry. Manufacturing capital investment per worker was multiplied by 6 times over the period in question. But the return per dollar invested, while it has fluctuated widely between good years and bad, showed no general upward trend over that portion of the period for which measurement is practicable.

Incentives in American Manufacturing

There has been, historically, a remarkably consistent pattern in the division of the realized income from the expanding manufacturing output of America. Reliable statistics are not available for as far back as 1870, but from 1899 through 1939 the average share of wages and salaries has been 82½ per cent against 17½ per cent as the share to investors (including dividends, interest, rents, royalties, and non-corporate profits). There have been, from year to year, relatively minor divergences from this pattern of distribution, but there is no discernible trend during the period away from the averages cited.

It is suggested that the persistence of the average 17½ per cent share of realized income from manufacturing that was maintained for the 40 years preceding World War II may represent the proportion that is needed to produce the dividends, interest, rents, royalties, and non-corporate return that will provide for the continuing investment upon which an expanding productivity such as we have had in the past depends. At any rate, it would seem reckless to depart too radically from such an established pattern at a time when unprecedentedly large private capital investment is counted on to make up for the drastic curtailment of such investment during the war years, and to carry us to the new high levels of civilian production set as our postwar goals.

The Distribution of Manufacturing Income in War

At the beginning of the war, the Government adopted controls and a tax program designed to prevent wartime activity from resulting in un-

duly swollen private returns. Due primarily to huge volumes, the profits *before* taxes of manufacturing industry were very high, but throughout the war its profits *after* taxes averaged returns no larger than they had been in good prewar years. Relative to volume, they were considerably lower than in prosperous years in the past. Again, there can be no complaint at results that generally were in accord with a national wartime policy.

But it is fair to note that the wages of manufacturing labor were allowed to increase substantially during the war. Between January 1, 1941 and April, 1945, average weekly earnings per worker increased by 77 per cent. This was, in considerable part, a result of increased working hours and a shift from low- to high-paid industries, but straight-time hourly earnings on the same jobs increased about 40 per cent against a cost-of-living rise of about 30 per cent.

The net result was to alter drastically the 40-year relationship of the 17½-82½ per cent division of Realized Income from Manufacturing. The share of wages and salaries increased to over 90 per cent, and the investment share shrunk to less than 10 per cent.

Its Postwar Distribution

This wartime shift in the proportion of distributive shares has an important bearing upon current wage controveries. With union demands for wage increases ranging up to 30 per cent, and the economists of the Office of War Mobilization and Reconversion asserting that an average increase of 24 per cent is feasible without raising prices, it is pertinent to inquire how such increases would affect the prewar ratios that governed realized income distribution in manufacturing.

Forecasting is always hazardous, but if we assume (1) that in 1946 we shall reach the $160 billion level of national output which the Government proponents of general wage increases expect, and (2) that there will be little increase in productivity because of the continuing process of reconversion, and (3) that the Government will succeed in carrying its announced purpose to maintain present price ceilings, it appears that a 24 per cent general wage increase would reduce the share going to capital from 17½ per cent to 11 per cent even allowing for its increased return resulting from the repeal of the excess profits tax. The prewar ratios would be about maintained if wages remained at present levels.

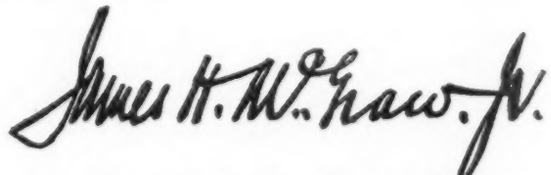
Conclusion

Since the maintenance of these prewar ratios was accompanied by an unparalleled rise in the "real wage" of American workers, there is a powerful prima facie case for not tinkering with them. It should be noted, however, that some economists think that the size of the investment share of manufacturing income tends to provide more capital than can be absorbed by a mature economy, and thus contributes to those breaks in the expansion of the economy which, as stated at the outset, have been its principal blight.

Regardless of what may ultimately prove to be the validity of this view, no one can responsibly contend that at this early but crucial stage in the reconversion process is the time to test it. Now, no one knows whether, or what dimension of, additional wage increases can be supported without forcing up prices or reducing profits to a point that will discourage vitally needed private capital investment.

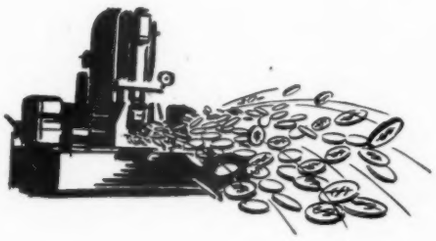
We want high and increasing wages in American manufacturing. We need them to provide an active incentive to workers to support expanding productivity, as well as to continue the trend of rising living standards in America. Equally, we need a continuing profit incentive of sufficient attractiveness to call forth the new investment upon which expanding productivity depends.

We can never attain our dual objective if we push one of these aims so far and so fast that it defeats the other.



President, McGraw-Hill Publishing Co., Inc.

ROUND TABLE



Profit Taker or Profit Maker?

"THIS WAS A DAY!" Ed settled back into Al's car for the trip home. "Another one like this and I'll be all set for a nice stay at the booby hatch."

"What gives? You didn't have to get out an extra hundred latch assemblies—and with three screw machines down for repairs. What happened—somebody chip the enamel on your locker?"

"Listen here, Al, just because you have to get out so many pieces a day, and I don't, don't get the notion a toolroom is a soft snap. Something is always going wrong, just like it does in the shop."

"Well, maybe so, but you always seem to be on your duff reading a magazine when I come by. What's the matter—did the old man get up on the wrong side of the bed again today?"

"No, I just was having trouble with that new miller. Kept running hot. It seems that just about the time I get a machine well broken in, the Old Man sells it or moves it out into the plant. Then I have to go through all the headaches of tuning up a new one."

"That's part of the Old Man's policy of keeping the plant up to scratch. Seems to have worked pretty well, Ed—the Old Man has paid a whopping big income tax for years."

"Don't fool yourself, Al. Everybody that owns a plant has been looking for places to put his dough. The Old Man can afford to keep his plant well equipped when Uncle Sam is paying most of it."

"You've got the cart in front of the horse, Ed. The reason the Old Man has done so well is that he's kept his plant up to snuff all these years. Newer machines work better and faster. They pay out in jig time."

"Al, you seem to be one of those boys that think the minute a machine begins to run sweet it's obsolete. Maybe you think men ought to work only about ten years, too; then they're all worn out."

"There you go—bringing up that old comparison between men and machines again. Men can learn something new as time goes on, but a machine can't change to meet the times."

"Ever try to teach an old dog new tricks, Al? You're just trying to confuse the point. I say, as I said before, that the Old Man is buying new equipment all the time because he can afford it."

"And I say, Ed, that he can afford new equipment because of the money it can save him over the old."

"Let's put it up to the boys at the poker session tonight, Al. This sounds like a better argument than that one about whether mortar holds bricks apart or holds 'em together, or the other one about the chicken and the egg."

What is the straight of it? Is a shop well equipped because the owner can afford it, or can the owner afford it because the well-equipped shop increases his profit percentage? Have you any ideas on the subject, any experiences that might support either contention? Or is this really an argument over priority between chicken and egg? Reader opinions will be welcomed, and those published will be paid for.

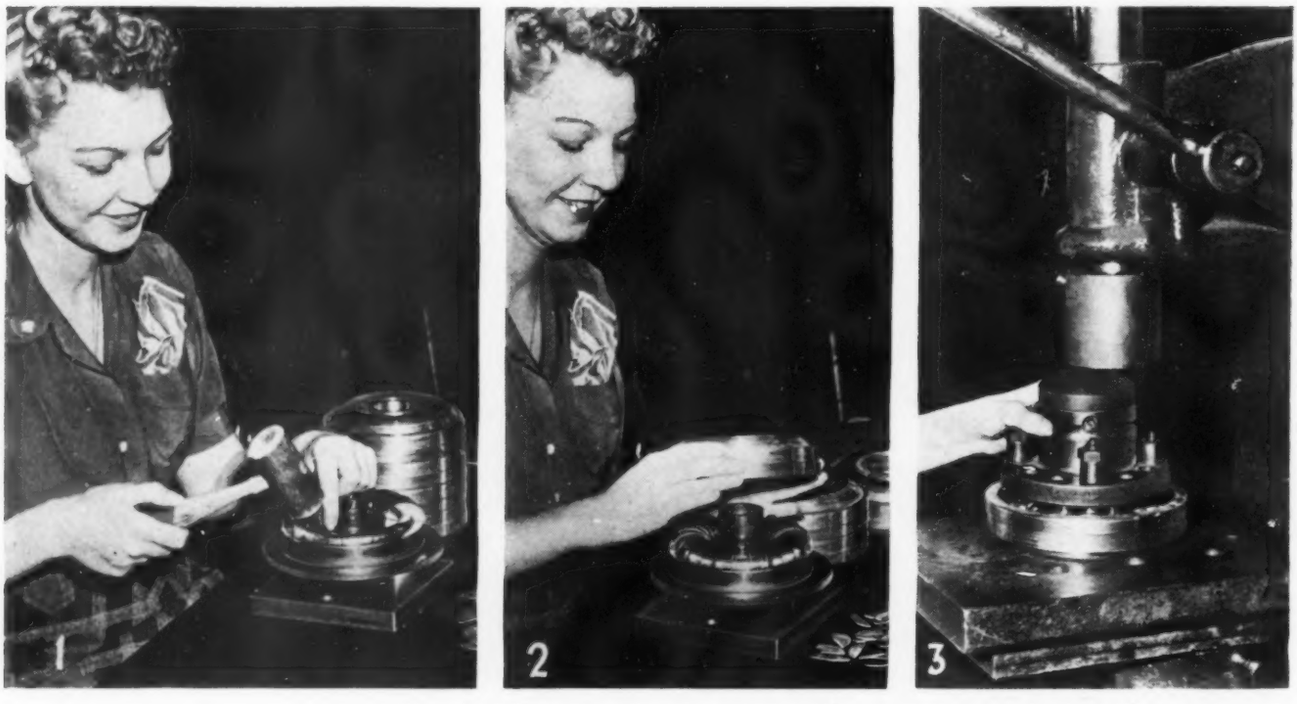
Single Department Saves Backtracking

One department head has complete control of assembly, brazing and inspection, centralizing authority

Supercharger fluid drives are assembled, brazed and inspected in one department at Nash Motors. This places production responsibility in the hands of one department head.

The drive consists of two members, one driven and the other driving, with the latter acting as an oiltight housing. The shaft of the driven member passes through a removable coverplate. Paddlewheel-like torus rings in each member are identical and assembly procedure is the same. There are 26 simicircular vanes in each element. Inserted on a hollow ring held in a special fixture, vanes are pressed into final position in the proper housing and preformed copper wires laid adjacent to each joint to be brazed. Supported on a special base, the unit is covered and passed through a hydrogen-atmosphere brazing furnace. Hot fluid copper flows into the joints by capillary attraction. Location of the furnace between the end of the final-assembly line and the final-inspection section minimizes handling time.

Components for complete assembly of supercharger fluid drive. Torus rings and 26 blades are at extreme right. At extreme left are driven member, an assembled ring with blades and the main driven member. In the center are the driving member housing with and without the ring, and two heaps of preformed copper brazing pieces



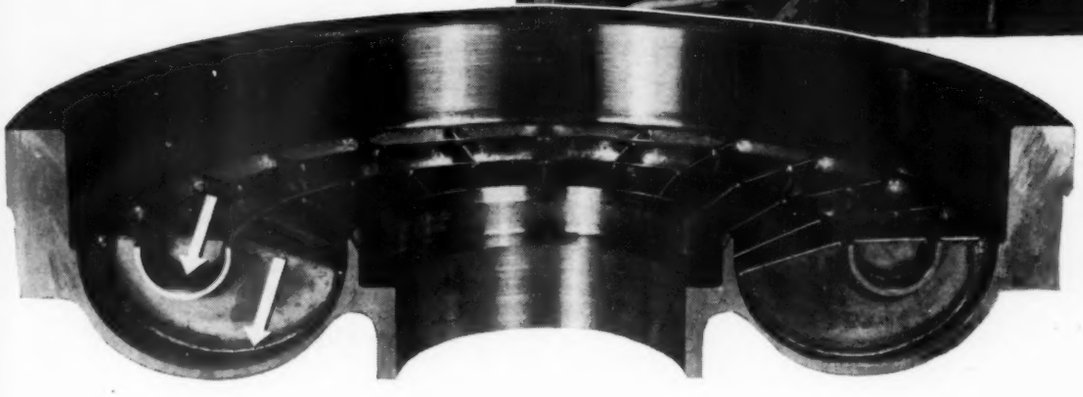
Assembling a torus ring in a special fixture. Blades are inserted into saw kerfs in the hollow-ring member. A driving housing is placed over the torus ring while it is still on the assembly fixture and an arbor press seats the torus ring and blades in the housing, assuring proper positioning of the individual parts before they are brazed

In Producing Supercharger Drives

Preformed copper-brazing wires are applied to rings with tweezers and blades seated in their respective housings. Operators are working on the driven members. At the right are driving members ready to go into the furnace

Assembled units are placed in the hydrogen-atmosphere furnace to copper-braze the whole assembly. Note how they are covered and set up on pedestals to assure uniform distribution of heat and prevent distortion

Cross-section of assembly, showing the shape and two of the points (arrows) at which preformed copper-brazing wires are placed before units enter furnace



Automaton Bubble-Tests Light-Metal Castings

BY ROY CUMMINGS

CHIEF QUALITY ENGINEER, PROPELLER DIVISION, CURTISS-WRIGHT COPORATION

Porosity and like flaws found 16 times faster with a semi-automatic fixture incorporating adjustments for test pressure

SIMPLE HOLLOW ALUMINUM and magnesium castings requiring low-pressure (5 to 50 psi.) air tests for porosity and other flaws were formerly tested at Curtiss-Wright Propeller Division by standard hand methods. As in most such test setups, castings were sandwiched between rubber disks backed by metal plates held together with C-clamps, immersed in water, and the specification air pressure applied, all operations being performed manually.

Pressure-testing of hollow aluminum and magnesium castings to S.A.E. Aeronautical Material Specifications was simplified and accelerated through development by the Quality Engineering Department of a semi-automatic pressure-testing fixture. It consists of a pneumatic cylinder and piston, controlled by solenoid valves through a rotary thumb switch, which clamps the casting in position on a counterweighted movable platen, sealing off and submerging the casting in a glass-bottomed tank illuminated from underneath. This operation is performed in one continuous motion. Flaws are readily located by air bubbles when test air pressure has been applied to the interior.

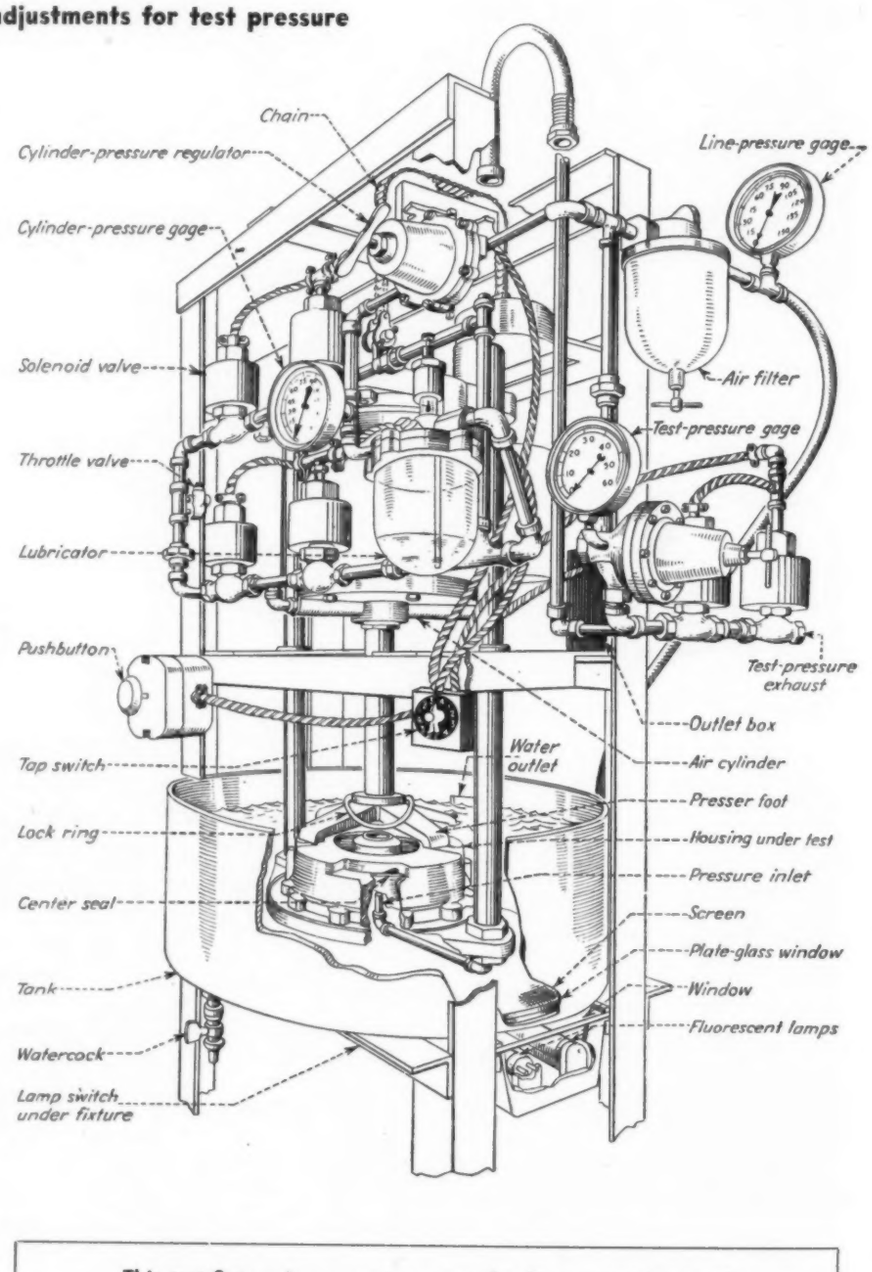
Operating Cycle

The operating cycle of this fixture is:

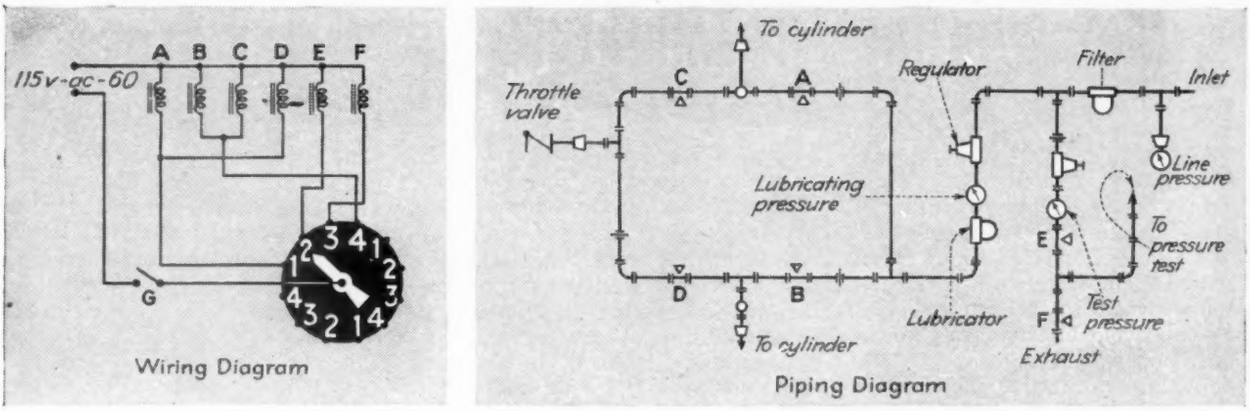
1. Operator places casting in proper position on platen.

2. Spring-loaded safety palm switch is depressed with left hand. Tapswitch is rotated to position 1. Piston drives presser foot against casting, sealing off casting at platen gasket and moving platen into test position within the water tank.

3. Safety switch held in depressed position. Tapswitch rotated to position 2. Piston, casting, and platen remain in test position. Test press-



This test fixture incorporates gages for line, operating, and test air pressures, regulators for operating and test pressures, lubricator and air filter. Piston speed is controlled by an adjustable throttle valve in the exhaust port



These schematics detail the hookups. *A* to *F* are solenoids, *A* and *D* controlling downward stroke of the piston, *B* and *C* upward stroke, *E* entrance and *F* exhaust of air for the pressure test. *G* is a palm-operated safety switch near a 12-position tapswitch with 360° rotation. Tapswitch positions with the same numbers are interconnected

ure is applied to casting through solenoid inlet valve. Test air is led to casting through right-hand (facing fixture) hollow guide column and thence through platen. The center casting seal is carried on a light spring but instantly seals off central casting opening with the application of test pressure.

4. Safety switch held in depressed position. Tapswitch rotated to position 3. Air at test pressure in casting exhausts. Casting and platen remain submerged.

5. Safety switch held in depressed position. Tapswitch rotated to position 4. Piston returns to loading position, followed by casting and counterweighted platen. Fixture is unloaded and ready to repeat cycle.

Performance, Accessories, Maintenance

The average floor-to-floor time for the test of each casting is 15 sec. Time required to complete a test by the old method was 3 to 5 min. and required considerable work. Thus, this fixture cuts time 16 to 1. It is much less fatiguing for an operator, exposes a large casting area for observation, and allows more precise control of quality as test and operating pressures may be preset by supervisory personnel and may be checked at any time merely by glancing at the pressure gages from a distance.

A number of different presser feet and sealing gaskets are supplied and are interchangeable for use with castings of other dimensions. It is desirable to connect the water inlet to the bottom of the tank, allowing a slight overflow at a large outlet near the tank top to remove floating foreign material introduced by dusty castings. The fixture was designed for efficient performance at operating pressures between 90 and 100 psi. in conjunction with test pressures of 5 to 50 psi., although satisfactory performance may be obtained over a somewhat greater range of pressures. During two years of continuous operation of a number of these fixtures, maintenance has consisted only of lubrication, cleaning the air filter, and occasional renewal of casting sealing gaskets and fluorescent lamps.

Veterans in Wheelchairs Learn Inspection Work

WAR VETERANS confined to wheelchairs at the Percy Jones General Hospital Annex, Fort Custer, Mich., are being paid as they learn to become industrial inspectors. The modern, hospital training plant is called "Valor." Special benches enable trainees to get wheelchairs close to precision measuring instruments made by Federal Products Corporation. Dial indicator gages permit rapid spotting of variations in specifications. The veterans, who are suffering spinal injuries, work four hours a day and are paid by the Eaton Manufacturing Company. The program might be extended to include bed-ridden patients.

Metalworking in Miniature

CRIES of "kid stuff" when plant-layout models were introduced have given way to such elaborate scale setups as this one showing the Kaiser-Frazer conversion for Willow Run.

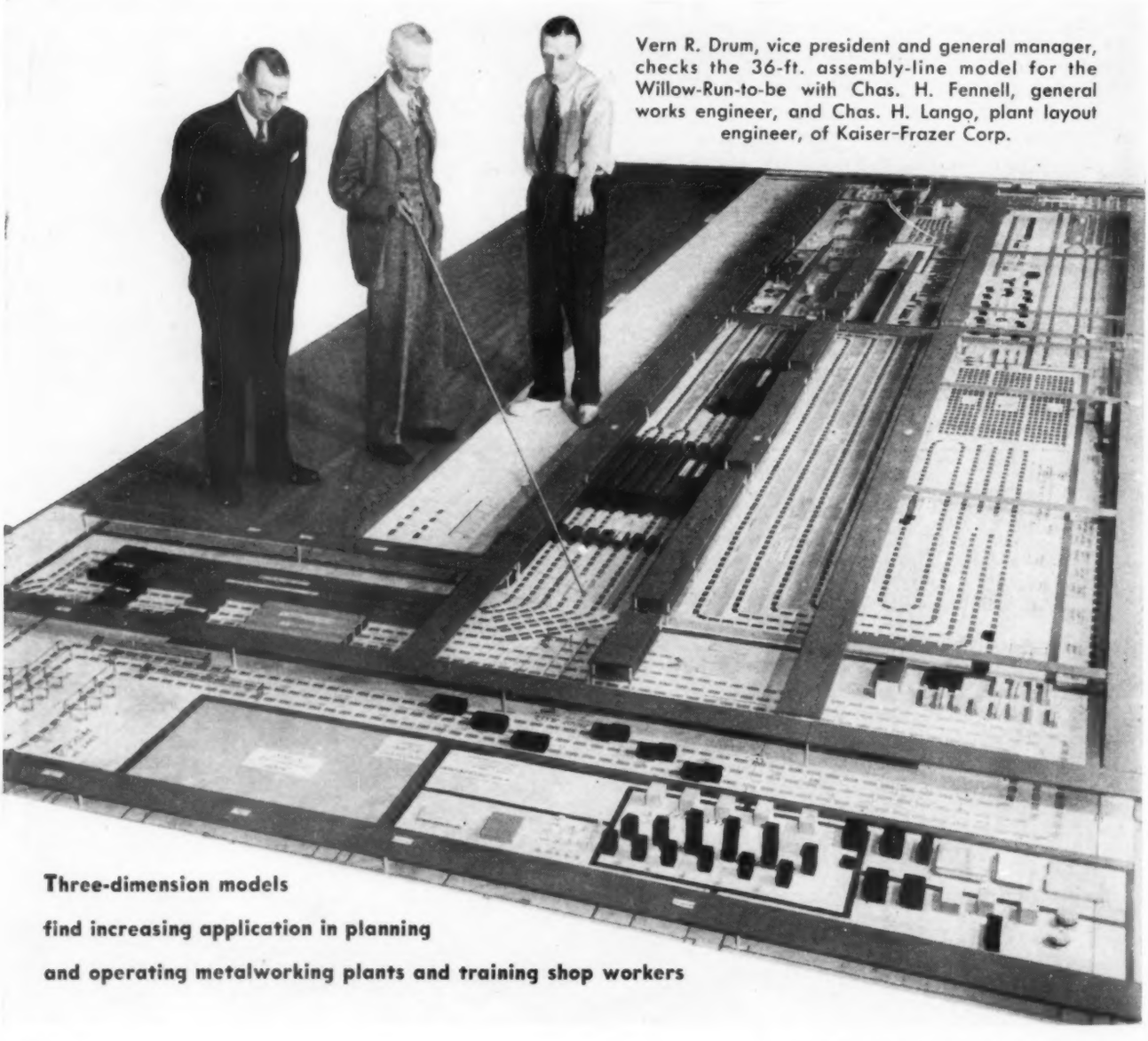
Power engineers have used models for many years to check locations of units and avoid interference in complex piping which no drawing could hope to show. First applications in metalworking plants were in planning assembly lines such as this to insure proper conveyor clearances, bin locations and work positions. Later, the same system was used on production lines.

Present applications are much more general, involving detailed scale miniatures of production equipment and even miniature male and female operators in various standard working positions.

Diecast units to standard scale are available commercially. As a consequence, models are used not only in planning installations, but also in demonstrating methods, in orienting and training workers, in sales work, even in production control. The Army, for example, had in operation at Wright Field during the war a model of an engine repair line that was electrically synchronized with the line itself. Tiny dollies matched the positions of their full-sized counterparts on the line, each carrying a tab identifying the engine and giving other pertinent information.

Several companies are already equipped to supply scale models of their equipment, so a prospective customer may test them on his own floor plan or model. Typical is Allis-Chalmers, which has just announced such models of electrical switchgear. Others may be expected to follow suit as the practice gains greater acceptance.

Much of the present impetus toward model layouts may be credited to the wartime trend toward visual aids, which brought simplified instructional and training manuals, greater use of color, movies and slide films, and perspective sketches instead of blueprints. Models take longer to produce and cost more, but with them there is little excuse for misunderstanding and mistake among the many specialists involved in layout and operation of a metalworking plant.



Vern R. Drum, vice president and general manager, checks the 36-ft. assembly-line model for the Willow-Run-to-be with Chas. H. Fennell, general works engineer, and Chas. H. Lango, plant layout engineer, of Kaiser-Frazer Corp.

Three-dimension models find increasing application in planning and operating metalworking plants and training shop workers

Tolerances on Assemblies

BY BENJAMIN EPSTEIN, HEADQUARTERS QUALITY CONTROL, WESTINGHOUSE ELECTRIC CORPORATION

I. The manufacturing engineer is faced with the general problem of relating the over-all tolerance of an assembled dimension to the tolerances of the component parts. This is an important question and arises in many ways. As typical instances one may cite:

(a) The fitting of an assembly into a confined space;

(b) The control of size of air gap in electrical devices such as contactors;

(c) The determination of tolerances of plated, enameled, or heat-treated parts.

Elementary statistical methods are used in this article as a basis for establishing a sound procedure for the determination of assembly tolerances.

As a simple illustration of how tolerances may be determined, consider a problem in which an assembled height denoted by X is built up by stacking blocks of heights X_1, X_2, and X_3 on each other. The drawing limits of X_1,X_2, and X_3 are taken to be:

Drawing limits of X_1 : 1.000±.003 in.

Drawing limits of X_2 : 3.000±.004 in.

Drawing limits of X_3 : 4.525±.006 in.

If it is further assumed that the dimensions of X_1, X_2, and X_3 are normally distributed with the drawing limits as the $\pm 3\sigma$ limits of the distribution (where σ is the standard deviation), then one is in a position to calculate the proper drawing limits of $X=X_1+X_2+X_3$. They are found as follows:

The nominal dimension of X = the sum of the nominal dimensions of the components = 1.000 + 3.000 + 4.525 = 8.525 in. The drawing tolerance of X about the nominal is found by computing the square root of the sum of the squares of the drawing tolerances of the components, i.e.:

Drawing tolerance of X

$$= \pm\sqrt{(.003)^2+(.004)^2+(.006)^2}$$

$$= \pm\sqrt{.000009+.000016+.000036}$$

$$= \pm\sqrt{.000061} = \pm .0078 \text{ in.}$$

This means that the drawing limits of X should be given by 8.525 ± .0078 in.

II. Statistical basis for the determination of tolerances

The validity of the calculations in the previous paragraph is a consequence of a well known statistical result. This result is given in Rule I.

RULE I.

If a variable X_1 possesses an average M_1 and standard deviation σ_1, and if a variable X_2 possesses an average M_2 and standard deviation σ_2, and

: : :

: : :

if a variable X_n possesses an average M_n and standard deviation σ_n, then the variable X which is defined by $X=X_1+X_2+\ldots+X_n$ possesses the average $M=M_1+M_2+\ldots+M_n$ and the standard deviation

$$\sigma=\sqrt{\sigma_1^2+\sigma_2^2+\ldots\sigma_n^2}$$

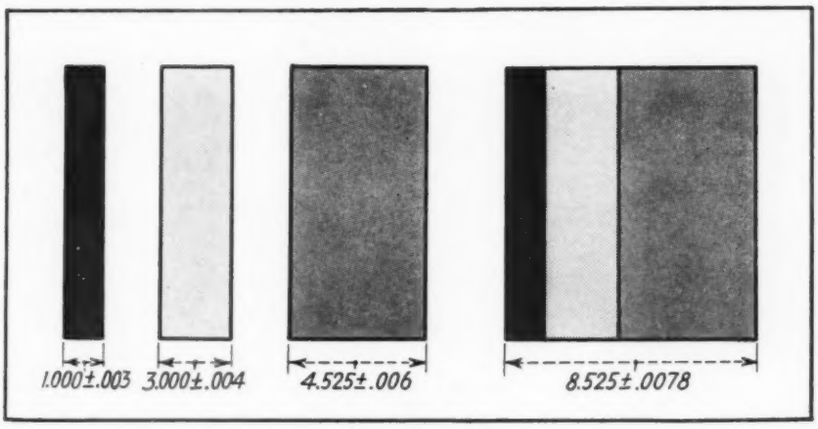


Fig. 1—The over-all tolerance on an assembly is equal to the square root of the sum of the squares of the component tolerances

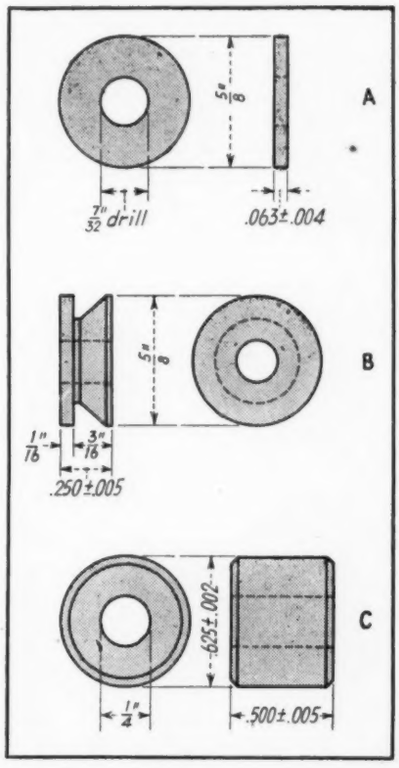


Fig. 2—These three items were used to test the validity of predictions

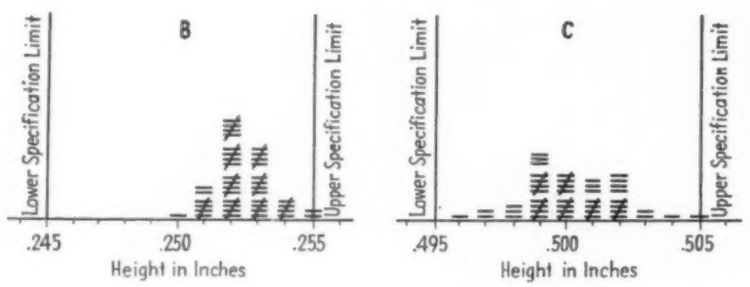
III. Comparison between theory and practice

As a practical verification of Rule I, the following test was conducted:

Three items each possessing flat top and bottom surfaces were selected for the experiment. Denoting the items by A, B, and C, the drawing tolerances were:

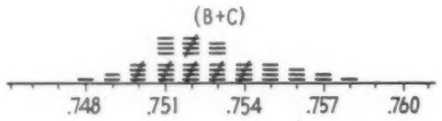
Item	Drawing Tolerances
	A—.063 ± .004 in.
	B—.250 ± .005 in.
	C—.500 ± .005 in.

Samples of 50 of each of the above items were drawn at random from sub-lots which had been produced



Drawing Limits — $.250 \pm .005$ in.
Sample $\overline{X}_B =$ .2524 in.
Sample $\sigma_B =$ .0010 in.
$\overline{X}_B \pm 3\sigma_B =$ .2554 in. / .2494 in.

Drawing Limits — $.500 \pm .005$ in.
Sample $\overline{X}_C =$ .5003 in.
Sample $\sigma_C =$ .0018 in.
$\overline{X}_C \pm 3\sigma_C =$ .5057 in. / .4949 in.



Predicted
$\overline{X} = \overline{X}_B + \overline{X}_C = .7527$ in.
$\sigma = \sqrt{\sigma_B^2 + \sigma_C^2} = \sqrt{(0.0010)^2 + (0.0018)^2} = .0021$ in.
$\overline{X} \pm 3\sigma =$ .7590 in. / .7464 in.

Actual
$\overline{X} =$ .7526 in.
$\sigma =$ .0022 in.
$\overline{X} \pm 3\sigma =$ .7592 in. / .7460 in.

Fig. 3—The results obtained when stacking *B* on *C*

in a single run by a single machine, and the sample average and sample standard deviation were computed in each instance.

The test then consisted of:

1. Stacking 50 *B*'s at random on 50 *C*'s, we obtained 50 $(B + C)$'s. The average and standard deviations of the $(B + C)$'s were computed. These calculated quantities were compared with the predictions of theory.
2. A similar approach was used with stacks of three employing *A*, *B*, and *C* at random.

In Fig. 2 all the pertinent information relative to dimensions, tolerances and sketch of items *A*, *B*, and *C* is given.

In Fig. 3, a visualization is given of the frequency distribution of *B*, *C*, and $(B + C)$. Each stroke represents an observation. This is an illustration of what happens when one combines samples from two normal universes. It will be noted that the resulting distribution is normal with wider spread. The agreement between prediction and the results actually found is excellent.

In Fig. 4, a visualization is given of the frequency distributions of *A*, *B*, *C* and $(A + B + C)$. This problem is of interest since it can be shown that distribution *A* is significantly skewed. It will be noted, however, that this does not materially affect the distribution of $(A + B + C)$. The correspondence between theory and practice is still close. The detailed comparison between the predictions of theory and the results actually obtained is worked out in Fig. 3 and 4.

IV. Limitations on the method

It should be stressed that the results cannot be applied indiscriminately. Certain conditions must be satisfied if one is to depend upon random assembly of components rather than upon selective assembly. The problem of matching parts by selective assembly so as to avoid scrapping components which may be outside component tolerance limits is an important one, but this subject will not be treated here.

However, the results can be applied even in those cases where the components are drawn from a reservoir which is composed of a mixture of many lots, so long as each lot is subject to certain restrictions. A possible restriction is that a flow of lots be produced under control to the extent that no more than one lot in a hundred contains more than 10% defectives and that the $\pm 3\sigma$ limits for each lot exceed one-half of the total drawing tolerance. The combination of such lots may be represented by an addition of lots with shifting mean (See Fig. 5*A* and 5*B*). Clearly the sum of such lots will not be normal any longer, but

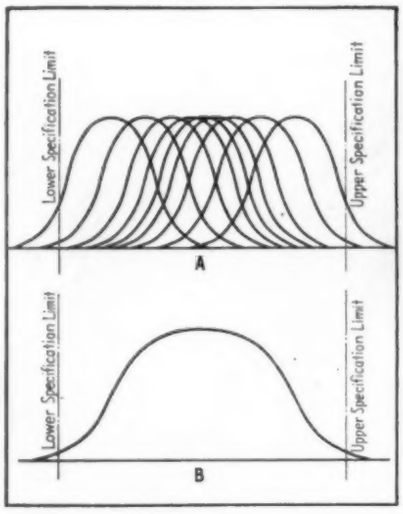


Fig. 5—Summation of a flow of lots with varying mean—most of the individual lots are within control

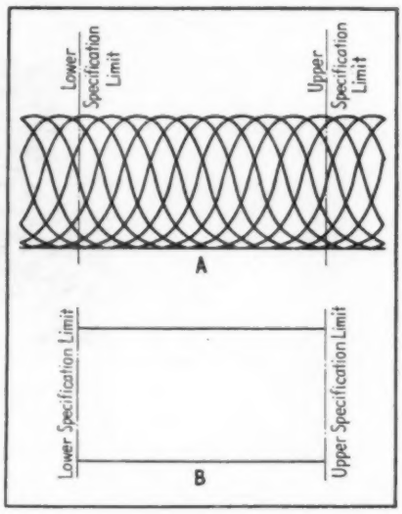


Fig. 6—Summation of a flow of lots with varying mean—many of the individual lots are not within control

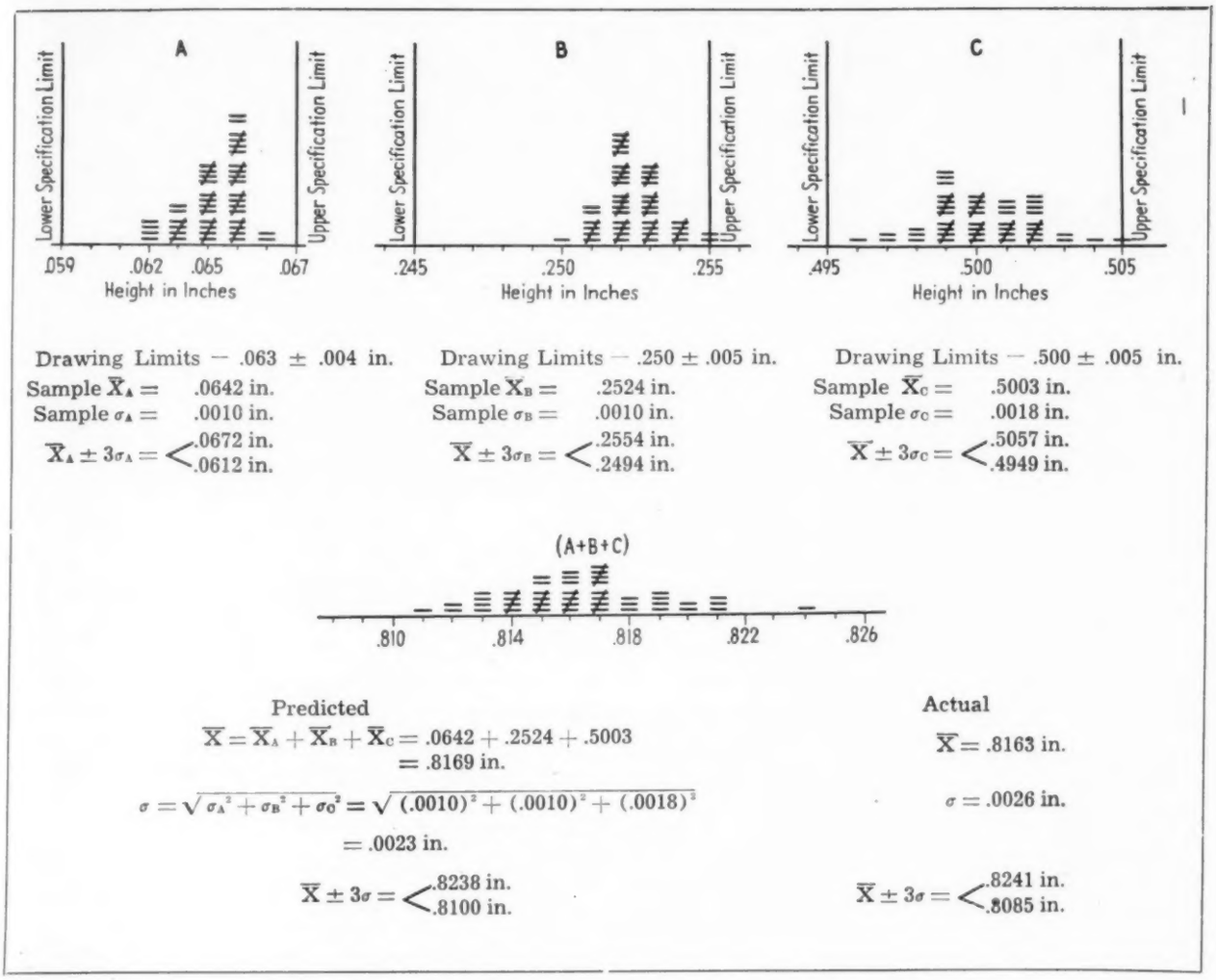


Fig. 4—The results obtained when stacking A, B and C at random

the results of this paper can still be applied with little loss in accuracy.

If, however, lots are produced which are far from being within control, then the results of mixing all lots together after screening out those parts which are outside the drawing limits will give us essentially a rectangular distribution (See Fig. 6*A* and 6*B*).

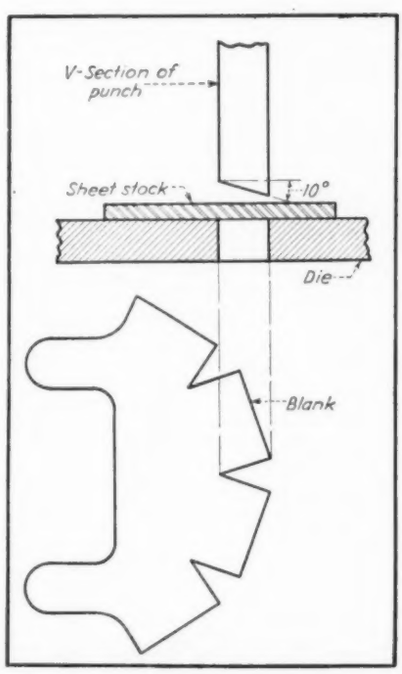
In such a case the results will not be valid; as a necessary prerequisite for their validity a state of control must exist during the production of the components.

• *Several months ago an article "Statistical Control of Assemblies Eliminates Selective Fitting" appeared in these pages. The present article contains the same basic information. It is reprinted in somewhat different form to correct certain errors present in the first version and to eliminate some editorial changes to which the author objected.* .

Angular Punches for V-Notches

BY CHARLES WESLOW

MY SCOTCH FOREMAN who knows more about die work than the average toolroom foreman, showed me a blank of 1/16-in. cold-roll stock, the die of which was made in a jobbing shop. In the sketch, you will note how sharp a point the three V cuts are. He ground off the points of the punches to an angle of ten degrees, so that the wide part of the punches cut through the stock first. Then there was very little resistance left for the points to go through. Thus the points stood up as well as the rest of the cutting edge.



Grinding a 10° shear angle on a punch protects the point when sharp notches must be stamped out

Angular and 'Straight' Cuts Combined

Two bores, one square, one at an angle, were machined together by setting one toolbit 90° ahead of the other. Principles are given

BY E. J. TANGERMAN, MANAGING EDITOR

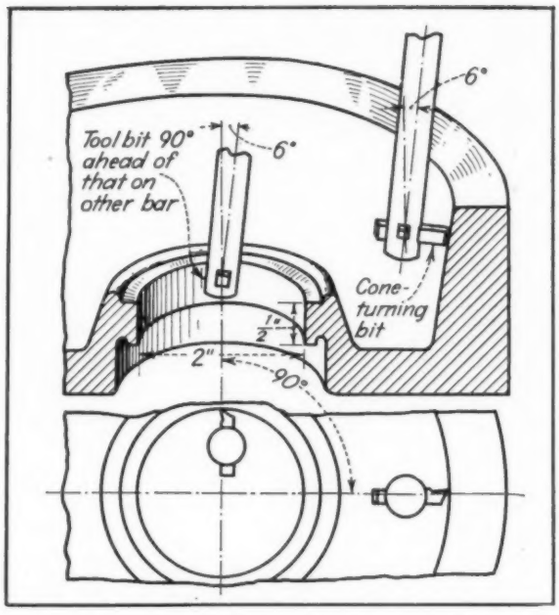


Fig. 1—A cone-shaped clutch face and a straight bore are cut together with this setup

TWO CUTS on a cone-clutch flywheel were combined on a vertical turret lathe by ingenious tool arrangement and a little application of basic trigonometry. The story was told our Detroit Editor, Chester S. Ricker, by A. R. Briney, vice-president, Jig Bushing Co., Pontiac, Mich.

The problem was to maintain the bearing bore concentric with the inside 6° cone of the face, Fig. 1. It was the practice to bore the 2-in. bearing hole first, then use it as a pilot while the cutter turning the clutch face was fed in at an angle of 6° with the axis of the work.

The suggestion that halved the time and assured concentricity was to set a boring bar on a second head *at 90° advance from the cone-turning bar.* Both bars, of course, pass through the work at the 6° angle, but the 90° lead of the inner one causes it to *cross the face* of the bearing bore diagonally—and to cut almost a parallel bore. The resulting error in parallelism of the sides of the bearing bore was reported as under 0.0001 in.

As this idea may be confusing and the principle may be useful in many other turning problems, I have attempted a step-by-step solution which can be applied generally, using only a table of natural trigonometric functions. My calculations, admittedly made by sadly neglected trigonometry, indicate the actual hourglassing at the center of the bore to be only 0.0003 in., more than the report, but still little enough to make the method thoroughly practical. Assume the toolbit, in moving down the 0.5 in. through the bore, crosses diagonally for distance 2a, Fig 3. It thus moves across the chord of the bore perimeter, its maximum withdrawal from the perimeter being at the halfway mark. Viewed in profile or elevation, Fig. 2, the motion creates a right triangle with included angle of 6° and adjacent side of 0.25 in. The tangent of 6° is 0.1051, so $a = 0.25 \times 0.1051 = 0.026275$.

Returning now to the plan sketch, Fig. 3, we have a right triangle with opposite side of 0.026275 and hypothenuse of 1 in. (bore radius). Our object is to find side x, which must be preceded by finding included angle ϕ. By inspection, *sine* $\phi = 0.26275/1 = 0.26275$, and angle ϕ (interpolated from a table) is 30′ 21″. *Cosine* $\phi = 0.999657$ (from a table of natural cosines), so $x/1 = 0.999657$ and $y = 1 - x = 1 - 0.999657 = 0.000343$. Thus the withdrawal from the true perimeter is so little that it is negligible for average work, at least for short bores.

Many turning operations, regardless of machine, involve a combination of angular and straight cuts. This principle may be applied easily to halve production time in some cases, if its probable error is thoroughly understood. In a long bore, two difficulties would preclude its use, excessive hourglassing and lack of clearance for the boring bar, unless the bore were large in diameter.

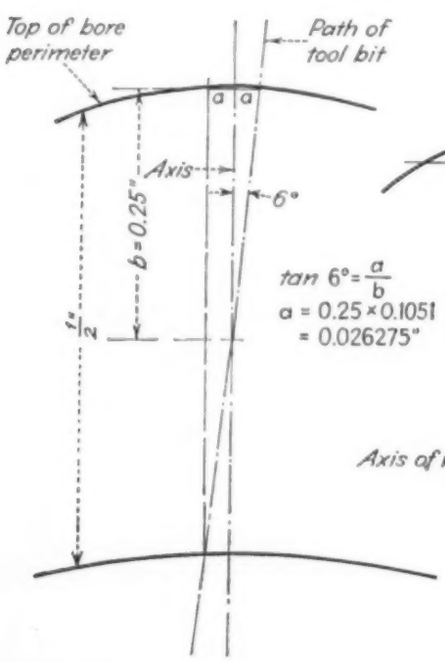


Fig. 2—This perspective diagram illustrates bar path and angles

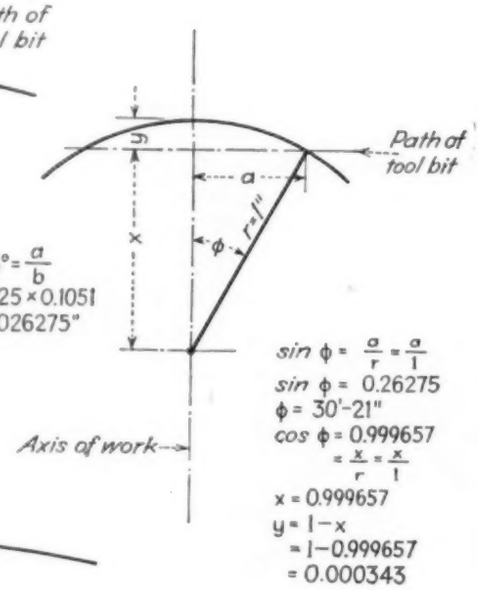


Fig. 3—Distance y is the error of the bar in traversing the bore

Practical Ideas

HAVE YOU A PRACTICAL IDEA? . . . If so, send it in. Your idea will help other men, in other shops, who have a problem similar to yours. We pay for acceptable contributions prepared exclusively for this publication

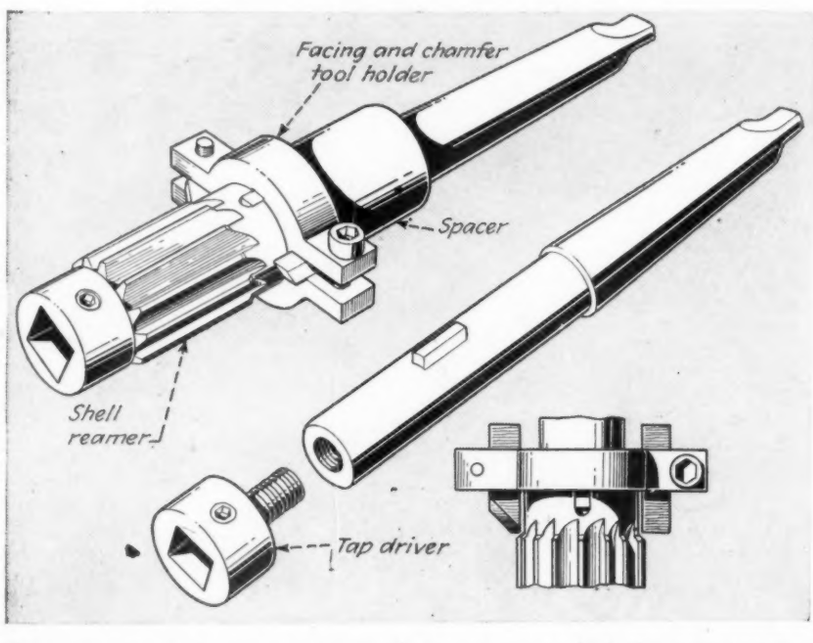
Combined Operations Demonstrated With Three Different Built-up Tools

THE FIRST PROBLEM was accurately to finish a multi-stepped hole, partly cut away on one side, within a tolerance of 0.001 in. The innermost of three sleeve end mills was itself step-ground for two of the counterbores, and carried a drill, which also served as pilot once it was started. This mill was pinned to a flanged, taper-shank arbor and the two outer cutters were pinned to the inner mill. Making the tool in pieces in this way reduced the cost and greatly facilitated sharpening. Provision was made for adjusting the components into correct relative position after regrinding (lower right). *Marchant Calculating Machine Co.*

A simple operation was the finishing of an aircraft wing hinge. A single end-mill was reground and relieved to provide two cutting edges with two diameters which reduced the time of the operation from two and one-half hours to twelve minutes.—*Edward L. Church, Douglas Aircraft Co., Inc., Chicago.*

A third problem was partially solved with a tool consisting of a shell reamer and two lathe toolbits fastened to the same arbor, one for spotfacing and the other for chamfering the corner of the hole, which was very satisfactory. But considerable time was wasted removing this tool, inserting a tap, and then replacing the original tool for the next piece. The tool was redesigned to incorporate a driving socket for the tap which did not interfere with reaming, but permitted quick insertion of the tap, thereby eliminating the necessity for changing tools.

A shell reamer arbor was modified by cutting away the shoulder, leaving only two projecting lugs 180° apart. A suitable sleeve was fitted on the mandrel first, enabling the facing and chamfer tool holder and the reamer to each occupy part of the lug. Tightening the tap driver against the reamer held all components together in a rigid unit. *Charles Maly, A. O. Smith Corporation, Milwaukee.*



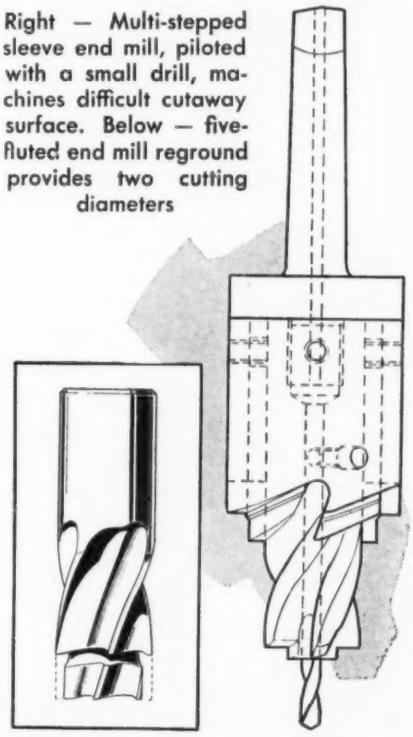
This composite tool uses a square-socket capscrew to lock the components

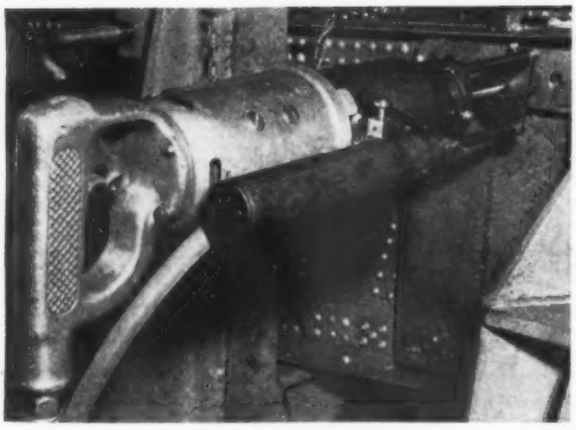
Air and Oil Control Feeds and Retracts Portable Drill

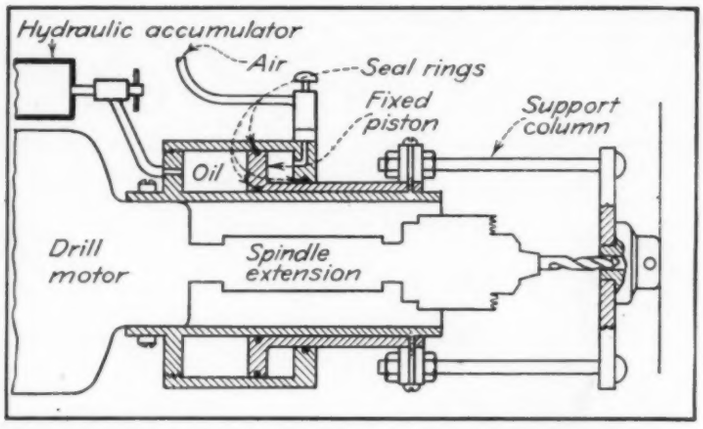
LAWRENCE HAGERMAN
Consolidated Vultee Aircraft Corp.

Here is a drilling attachment for air and electric hand motors which reduces fatigue and increases production. In this job the unit is shown bolted to an electric drill and adapted

Right — Multi-stepped sleeve end mill, piloted with a small drill, machines difficult cutaway surface. Below — five-fluted end mill reground provides two cutting diameters







Double-acting cylinder bolted to portable drill provides feed and retracting power. Here, it is being used on a wing spar with the aid of a special quick-lock arrangement

to a quick-damping support so it can be moved along the fixed structure being drilled.

The unit consists of a double-acting cylinder with air pressure on one-side and oil on the other. Depending on job requirements many control methods are possible; here, an oil needle valve is relied upon mainly to regulate the feed. The piston and piston "rod" are one piece and the "rod" is tubular. This piece is fixed to the work. The drill, chuck and spindle extension move axially within the "piston rod," and the cylinder, bolted to the drill, slides on the outside of the piston and "rod."

One control method employs a pushbutton 3-way air valve, and a needle valve in the oil accumulator. The air valve is normally open to the cylinder; holding the button depressed permits exhaust. To start the drill feed, the needle valve is opened admitting oil to the accumulator at a controlled rate. (Prior to opening the oil is trapped and motion is impossible). Cylinder and accumulator displacements are such that full piston travel will compress the air in the accumulator enough to provide adequate retracting power but never to approach the main air pressure. To retract, the 3-way air valve releases the cylinder pressure, and the needle is opened wide.

Adjustable Jig Clamps Angle Iron for Welding Frames

CESARE VICENZI

This tool has proved valuable and a great time-saver in the construction of frames of many sizes. The jig consists of four built-up clamping blocks held together with four adjustable rails.

Each block is composed of an L-shaped plate to which are attached the two slotted clamping pieces on top, and the two channels at right angles on the bottom. Blocks are made in pairs; each block has one of its channels upside down (with a covering plate fastened to the bottom) so the two rails can pass each other and meet properly at the other end. At one corner of the clamping frame both rails are permanently fixed. At the diagonally opposite corner, both are adjustable. At the other two corners one rail is fixed and the other adjustable. Rail adjustments are handled with capscrews, and the angle-iron held with bent-handle screws.

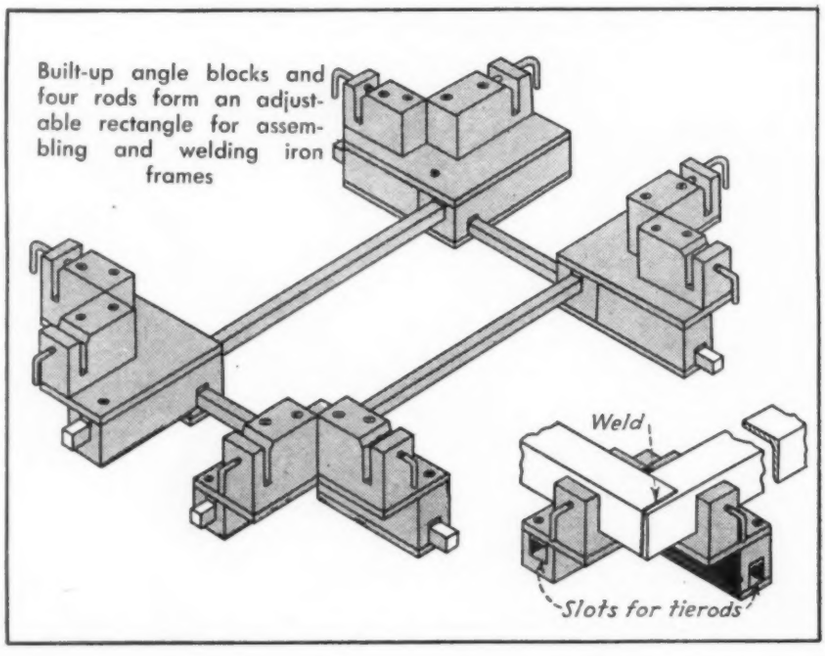
A wide range of sizes can be accommodated but if a smaller frame than the minimum size is required, the corners can be welded individually, using only one clamp-block.

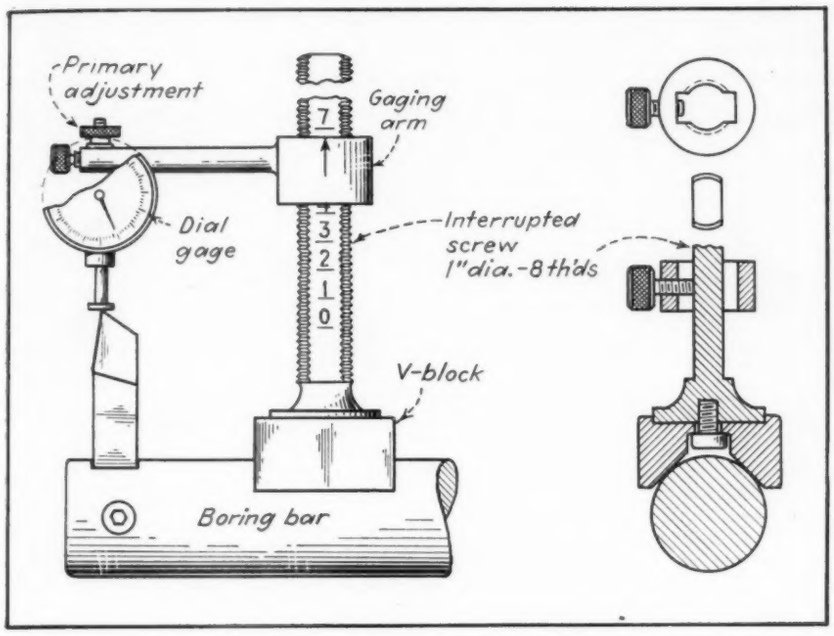
Interrupted-Screw Indicator Attachment Sets Boring Tools

A. F. SCOBLIC
Chief Tool Designer
The Heil Co.

Here is an indicator built for adjusting the toolbits in boring machines. The principles involved in its construction, however, make it quickly apparent that the tool will immediately compete with a standard surface gage in many kinds of work, and also can be adapted to other special applications.

The column is a 1-in. 8-thread screw, milled flat on two opposite sides to ½ in. thick. The collar fits this screw closely in one position, but is relieved on opposite sides also, so turning it 90° clears the screw entirely. The indicator head is slipped


Built-up angle blocks and four rods form an adjustable rectangle for assembling and welding iron frames
Weld
Slots for tierods



To use, indicator is first set to correspond with the boring-bar diameter; subsequent readings then are true diameter measurements

to the desired position, turned into the thread and clamped with the knurled setscrew.

As the tool is designed for setting boring tools to diameter of cut, the front flat on the column has been graduated in inches of diameter. (Four threads equal one inch.)

To prepare the tool for use, the diameter of the reference surface (bar diameter) must first be known, and the dial set to correspond. The collar is set on the column to the nearest ¼ in. and the screw-spindle supporting the indicator is adjusted with the dial button touching the bar, until the pointer indicates the proper number of thousandths to total the exact bar diameter. (Remember that the column reads inches of diameter while dial readings have to be multiplied by two). Now the instrument is set so, were verification possible, it would read zero at the center axis of the bar, and all subsequent readings are true diameters without further adjustment.

The V-block base is chosen to be suitable for the size range of boring bars which will be encountered. It is drilled, spotfaced and counterbored to receive the column and support it securely in a perpendicular position.

The sliding head is built with the arm fastened to the collar at right angles to the relief slot so the dial will be over the bar when the collar is engaged on the thread. The holding and adjustment of the dial gage is accomplished with a short screw spindle and knurled nut. After setting, the setscrew is tightened to prevent the possibility of subsequent accidental dislodging.

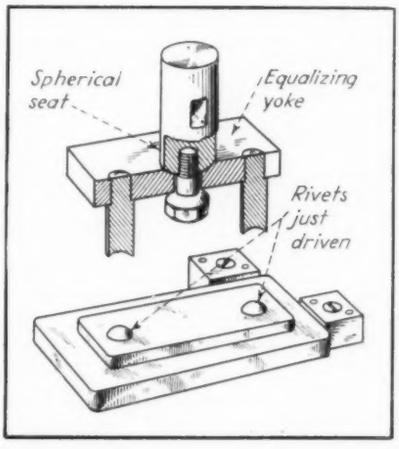
The chief advantage of this tool is that it virtually eliminates trial cuts. The roughing cut is quickly set, and the accuracy is sufficient for all but the finishing cut.

Equalizing Double-Punch Rivets Fiber Blocks

ROBERT MAWSON

In order to drive two rivets simultaneously into blocks whose thickness may vary, I decided to design an equalizing yoke carrying two punches. The toolholder is spherical-headed and the yoke is held loosely in place with a spherical nut through the enlarged hole. Both drivers are also cup-shaped to fit the round rivet heads. With these precautions, equal driving pressure and uniform rivets are assured regardless of minor surface irregularities.

Ball and rockered yoke is self-aligning for driving two rivets simultaneously



Floating Die Cleans and Finishes Defective Molded Parts

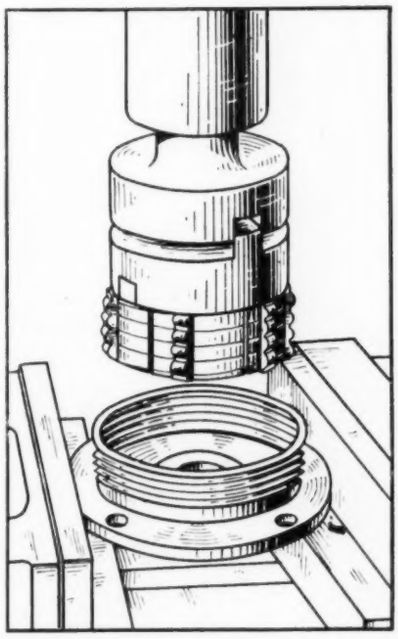
RODNEY A. MASTRUM
Kaiser Company, Inc., Portland

Many of these cast flange receptacles were imperfect when received and to eliminate the delay and expense of returning them to the vendor, a tool was developed for re-chasing the threads.

The unit consists of a double split-coupling one end of which carries a taper shank to fit a drillpress, and the other machined to receive the cutters.

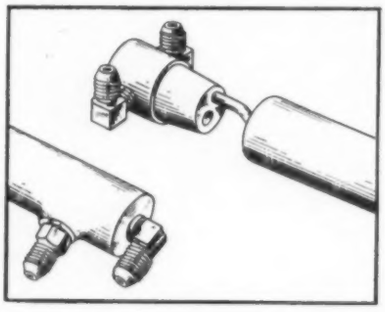
The freedom of drives allows the die to follow the threads in spite of slight mis-alignment using the same action as a step type standard flexible coupling. *Suggestion from the Board for Individual Awards, War Production Drive.*

This floating die avoids delay

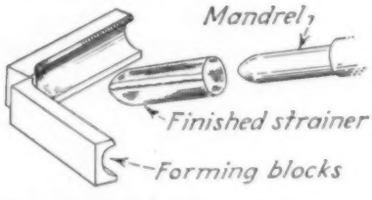


Wood Sandwich

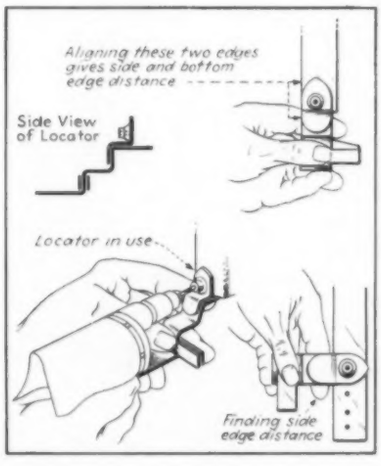
THAT WAR-SCARCE MATERIAL, plywood, is used by only 17% of machinery, equipment and parts manufacturers. 22% plan increased applications, 12% decreased. Of the 83% nonusers, 3% plan applications.



Spotweld Electrode Holder—By substituting a tapered plug which carries both coolant connections, the lost time for frequent electrode changes is greatly reduced. Formerly, both connections had to be unscrewed and then made up again for every change. *George W. Haggard, North American Aviation, Inc., Dallas.*

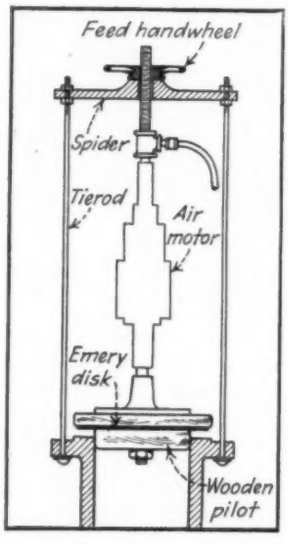


Soldering Strainers—Encountering considerable difficulty in forming and soldering an hydraulic-fluid strainer, this mandrel and sleeve were devised. Rejections were eliminated and each piece completed in 42 minutes, less time. *Ruth T. Bowen.*

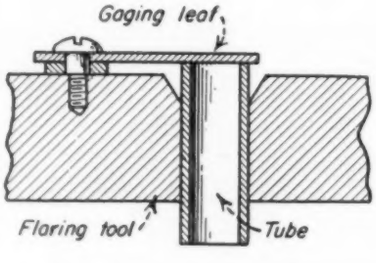

Aligning these two edges gives side and bottom edge distance
Side View of Locator
Locator in use
Finding side edge distance

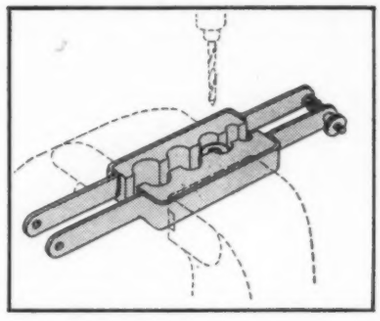
Edge Drilling Guide—A steel strip was bent, and drill bushing and handle welded to it as shown for rapid drilling of uniformly spaced holes without prior marking. *Carl Hiltunen, The Murray Corp.*

Flange-Facing Jig—An air motor is fitted with a wooden disk carrying suitable emery cloth, and a wooden pilot the size of the pipe I.D. Four rods are bolted through holes in the flange at one end and are adjusted at a spider which supports the grinder. After the spider is levelled in place, the grinder can be fed as desired with the central projecting screw. *Lawrence Cortese, Navy Yard, Philadelphia.*



Flaring Gage—To assure a uniform flare on the end of a tube, a simple swinging arm was attached to the tube clamp. Before this was done, the length of the tube projecting beyond the clamp was gaged by eye. If it was too short it had to be reworked, if too long it was scrapped. Putting on a stop that could be swung out of the way when the flaring was done solved the trouble, saved material and time. *Ernest Sewell, The Murray Corp.*





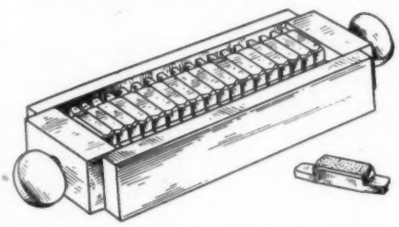
Self-Aligning Stud Clamp—A hand vise was constructed of soft metal with symmetrical halves and four holes to take studs from ¼ to 1 in. in diameter. This was flanged at the top so it could be placed level in a bench or machine vise for accurate vertical operations. As a general-purpose tool, much time has been saved as well as many broken drills, taps and wasted material. The drilled straps permit jobs to be assembled and held in place independent of the bench vise. *George Berdahl, Kaiser Company, Inc., Vancouver.*

Quick-Acting Vise—An answer to the cumbersome handling of large armature coils is found in this foot-operated vise. Its wooden jaws hold the coil firmly without damage, freeing both hands for re-taping or other repair, and the ratchet quadrant holds with the desired pressure by itself after it has been once set. *Charles R. Dixon and Lester Osterhorn, Navy Yard, Puget Sound.*

Box Holds Small Hones For Uniform Dressing

ELMORE THROCKMORTON
Wright Aeronautical Corp., Cincinnati

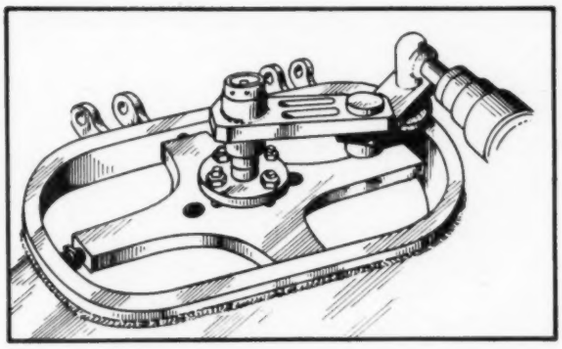
The hones for the Micromatic Hydrophoner were individually dressed with a file or emery cloth. The dimensional variations which resulted made it difficult to attain the uniform micro-finish required on the valve locks honed with this machine.



Thumb-screws clamp 18 hones simultaneously for rapid dressing

This box fixture holds 18 stones and insures that they are all dressed to the same thickness. Further, it avoids the necessity for truing on the honer and the consequent coolant contamination; it minimizes unnecessary hone wear; and it reduces machine down-time. Estimated savings were 800 hours per month.

One of these fixtures, costing only a trifle to make, is thus capable of serving several machines and breaking a serious bottleneck.



Adjustable spider with leveling plate permits accurate grinding of the flanged seats for watertight doors. Tedious checking for trueness is thereby eliminated

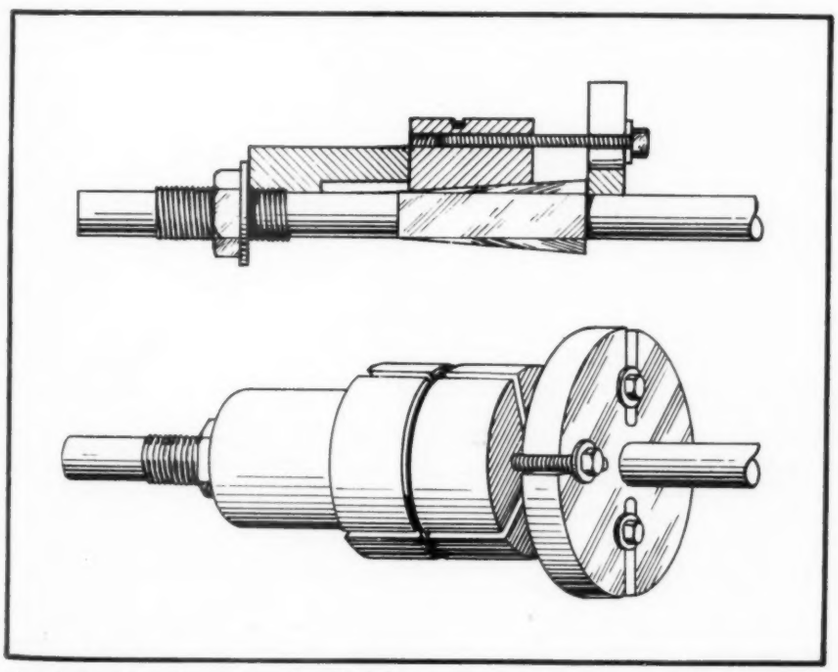
Universal Bracket Holds Grinder For Facing Seats and Flanges

JOEL S. BLOOD
Naval Drydocks, Hunters Point

Formerly, it was a slow and cumbersome procedure to check and recheck surfaces such as oval manhole flanges for watertight doors when the work had to be done after assembly.

This grinding attachment fits inside the aperture and is clamped tightly with the four screws at the end of each leg of the spider in approximately the correct position. Centering is of no importance, but a plane surface very nearly parallel with the bulkhead from which the flange protrudes is essential, and to gain this, a leveling plate has been provided. The pins and links are all of heavy construction and through the use of ball bearings, rigidity and freedom of movement in one plane have been combined.

The grinder mount shown is used for work in close quarters, but the principle involved in this machine has been adapted to different applications. For circular apertures, the elbow is, of course, unnecessary. *Suggestion submitted under the Navy Employees' Suggestion Program.*



Mandrel is turned and taper-milled from square stock; segment blocks can be expanded together or independently

Expanding Mandrel Has Wide Adjustment Range

EDMOND VAN BEVER
Naval Air Station, Quonset Pt.

This lathe mandrel is similar in application to a three-jaw universal chuck. The four segments can be expanded simultaneously or independently, thus permitting external operations on eccentric as well as concentric work.

The mandrel core is turned from a piece of square stock, the finished diameter of which corresponds to the small dimension of the truncated pyramid. After the rod is turned, the four sides are tapered from the large dimension down to the surface of the cylindrical section. The adjustable work-holding feature is obtained with four segment-blocks which form a cylinder when closed. The apex of each block is milled off with the same taper as the mandrel, and holes are drilled and tapped centrally in one end. A slotted faceplate fits against the taper on the mandrel to hold four capscrews for the independent adjustment. For simultaneous action, the large nut is advanced along the mandrel against the spacer-sleeve. A snap-ring holds the blocks in place when the tool is not in use.

The mandrel can be adapted to take taper-bored work by providing an assortment of tapered shims to be held

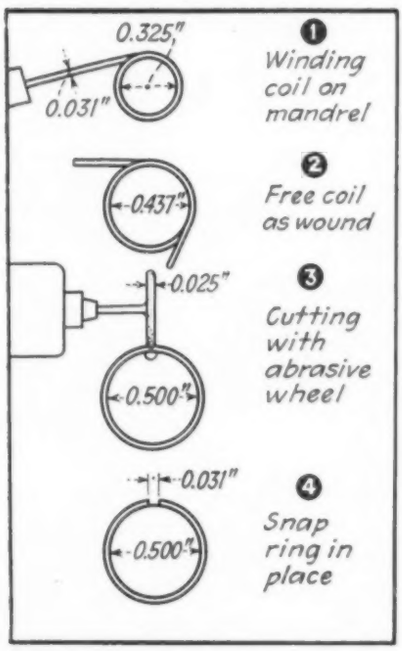
on the flats with short dowels. Tapered washers should also be used to prevent bending the capscrews.

Music Wire Snap-Rings Wound in a Lathe

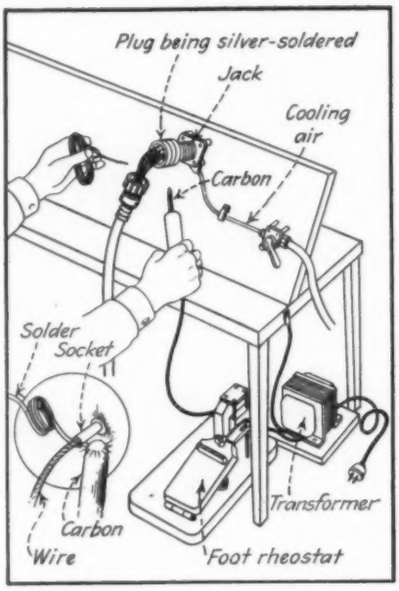
DAVID T. ARMSTRONG

The variety of problems that confront the small shop doing experimental work is endless and one shop will accumulate only so much experience. Therefore the sharing of little tricks is a very worthwhile procedure.

After several attempts to make snap rings, we finally wound a spring of 0.500-in. inside diameter and cut it into single loops. But the snap rings were not satisfactory because there was not sufficient tension left in the single coil to hold it in the groove for which it was made. The successful solution to the problem was as follows: 0.031-in music wire was closely wound over a 0.325-in. mandrel, making a finished spring of 0.437 in. I.D. The lathe feed was 32 threads per inch, which equals 0.031 in. per revolution). The coil was then expanded onto a ½-in. rod and cut with a high-speed hand grinder. Finally, each ring had to slip over a 0.562-in. shaft and into a 0.500-in. groove. As installed, the gap had only expanded from 0.025 to 0.031 in. and the ring was a snug fit.



Four steps in the making of ½-in. snap rings from music wire



Resistance-soldering machine uses carbon electrode and foot heat control, and has an air blast to keep the bench cool

Electric Plugs Soldered With Controlled Current

H. A. COLE
Bell Aircraft Corp., Georgia Div.

Rejected parts and slowness of former methods instigated the development of this successful soldering system. Here, a girl is shown silver-soldering the leads of a multi-conductor cable into its plug. The operation is difficult because of confined space; sufficient heat to fuse silver solder (torch or large iron) is hard to localize and completed joints often come apart while making a new one.

The essentials of this method are a high-current secondary controlled by a foot rheostat and a heat-insulated carbon electrode. Many types of transformer and control are possible and these probably can be chosen from quipment available. The rheostat can be in series either with the primary or the secondary, or, any of several variable transformers would serve.

Each operation is almost instantaneous: the cable is inserted in its cup and the dead electrode placed in position. With the current off, accidental bumping of other parts and consequent damage is eliminated. The current is regulated to just melt the solder, and as soon as it flows around the joint, the current is shut off without moving the electrode until the joint solidifies. In this way, the electrode can be used to help position and hold the work until the solder hardens in place. As the bench accumulates heat from constant use, an air blast is regulated to hold the table temperature within a comfortable limit and to prevent damage.

Angle Plate Checks Production Work Rapidly

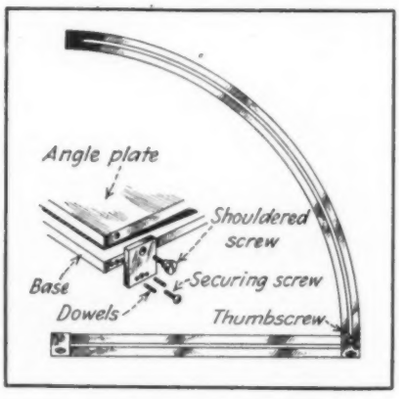
BY FRED RAYSER
Production Engineer
Fleetwings Division, Kaiser Cargo, Inc.

To prevent a bottleneck in the inspection department, when a rush of angular work came along, an adjustable fixture was designed by John W. Adams, conformity inspector.

The fixture consists of a table pivoted to one end to a baseplate; the other end slides along a curved arm with provision to lock the table at any position in between.

Work to be inspected is placed upon the table after the table has been elevated to the proper angle. The thick end of the work is placed at the hinged end of the table, the thin end pointing toward the graduated arm. With the workpiece in this position, the top surface of the wedge should be parallel to the base. If an indicator is moved over the top of the workpiece, and there is no movement of the needle, the surface is at the correct angle, all over: if there is a variation of the indicator reading, the angularity is not correct. With this fixture, the four corners of the workpiece can be tested to determine whether there is any twist.

While not incorporating the features of expensive tools, the fixture has proved valuable in checking simple angles; it is easily and efficiently operated.



An inclinable table, capable of being locked in proper position, is used to check the correctness of wedge-shaped pieces

Step-Drilling Taper-Pin Holes — I

AT THE 1945 annual meeting of the American Society of Mechanical Engineers, a draft of a recommended standard on machine pins was approved and transmitted to the American Standards Association for promulgation as a national standard. Types of pins covered in the proposed standard are: taper, straight, dowel, cotter and clevis pins.

That portion of the proposed standard having to do with taper pins is reproduced on an accompanying page. A supplement to the standard consists of drilling specifications for taper-pin holes. These data were compiled by H. W. Fahrlander, Director of Standards, General Machinery Corporation, and Chairman, Engineering Committee on Standardization of Engine and Tool Room Lathes, organized under the procedure of the National Machine Tool Builder's Association.

The reasons for compilation of these data were: (1) many shops may not have Gammons helical taper-pin reamers or at least in a wide range of sizes, and (2) step-drilling may be desirable, especially for the larger sizes, as a means of reducing the amount of stock to be removed by Gammons reamers. So, in either case, shops can use the older method of running a series of drills through a collar before using a taper reamer. The chart on this page is for step-drilling taper holes for taper pins up to No. 10 size; the chart on an accompanying page gives drill sizes and depth of drilling for pins from Nos. 11 to 14 inclusive.

To Obtain Drill Sizes

1. Determine depth of hole (pin length).
2. On appropriate chart, determine intersection of depth line with taper line.
3. Drill diameter will be the next smaller diameter on the horizontal line above the intersection.
4. If chart calls for three drills, divide the drilling depth into three equal spaces (nearest ¼ in.). If pin indicates two drills, divide the drilling depth into two spaces.

Example A (illustrated):

No. 10 pin—6 in. long.

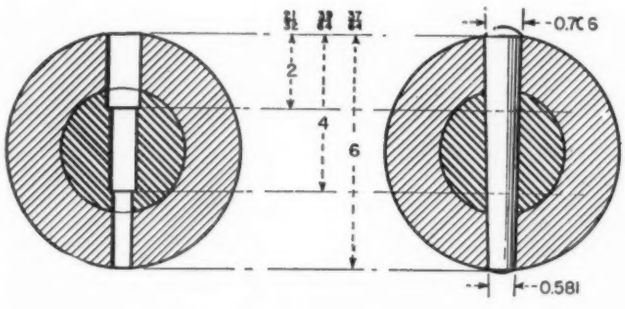
Chart shows 37/64-in. drill through; 39/64-in. drill 4 in. deep; 21/32-in. drill 2 in. deep.

Example B:

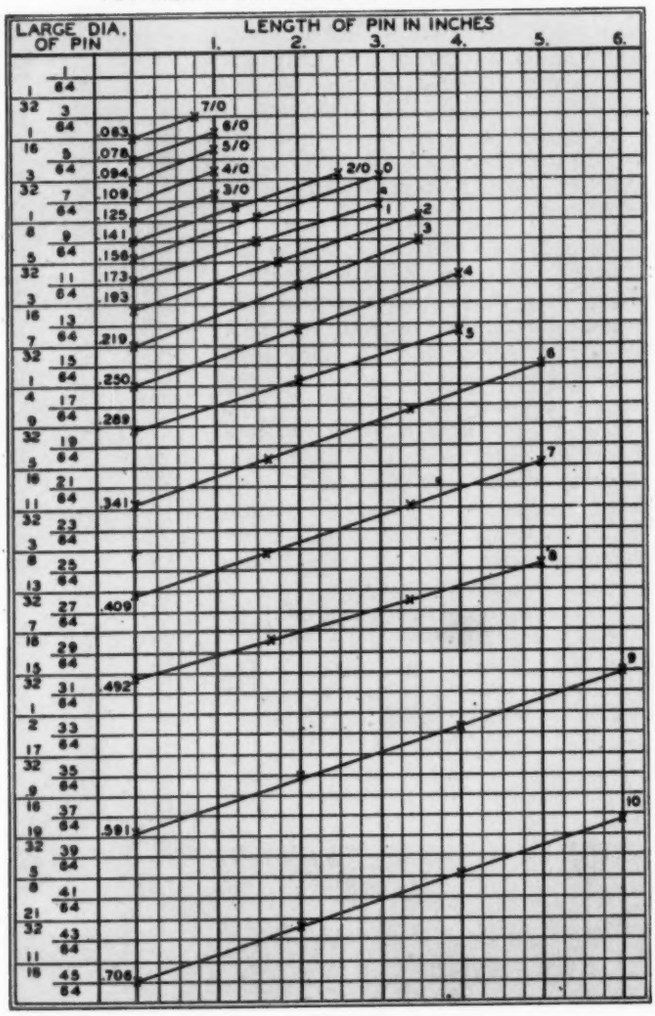
No. 10 pin—4 in. long.

Chart shows two drills needed: 39/64-in. drill through; 21/32-in. drill 2 in. deep.

All detail drawings should carry the above type of note as indicated in examples *A* or *B*.



SEE DRILL CHART AT BOTTOM OF PAGE FOR SIZE OF DRILL AND NUMBER REQUIRED.



DRILL CHART

SIZE PIN	1ST. DRILL THROUGH SIZE	SECOND DRILL		THIRD DRILL	
		SIZE	DEPTH	SIZE	DEPTH
7/0	3/64				
6/0	3/64				
5/0	1/16				
4/0	5/64				
3/0	3/32				
2/0	3/32	7/64	1-1/4		
0	3/32	1/8	1-1/2		
1	7/64	9/64	1-1/2		
2	7/64	9/64	1-3/4		
3	9/64	11/64	1-3/4		
4	11/64	13/64	1-3/4		
5	3/16	15/64	2-		
6	15/64	17/64	3-1/4	19/64	1-3/4
7	19/64	21/64	3-1/4	3/8	1-5/8
8	25/64	27/64	3-1/4	29/64	1-5/8
9	15/32	1/2	4-	35/64	2-
10	37/64	39/64	4-	21/32	2-

Here's Real Gage Block Service

WEBBER *Standard Gage Blocks... Heavy Duty Gage Blocks*

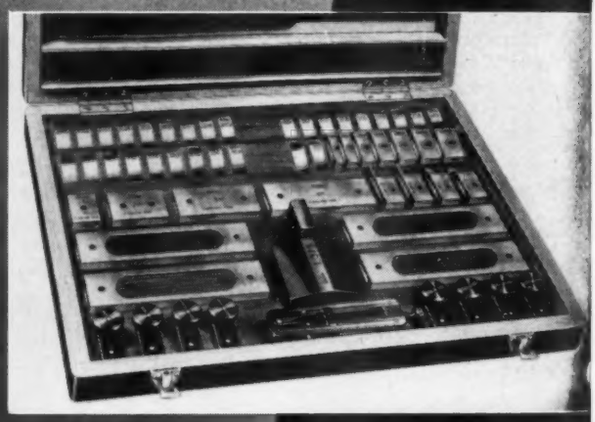
● In Webber Standard Gage Block Sets you get a wide working range with gage blocks made within 4 millionths of an inch accuracy. Webber Sets permit 250,000 measurements as compared to the average 125,000. This is made possible by the .10005 inch block included in all 84 and 43 block sets. Another advantage is the two wear blocks also included in these sets for use where blocks come into contact with the work. Dimensional accuracy – Stability – Surface Finish – Wearing Quality are inherent features of all Webber Gage Blocks.

Webber Heavy Duty gage blocks are practical, accurate measuring tools which may be quickly assembled into a precision Height Gage—an inside or outside Caliper or Divider. These extra large gage blocks with generous wearing surfaces all with accuracies within millionths of an inch bring the tool maker new precision in layout and inspection work. Note all 6 inch heavy duty blocks have walnut insulation strips to keep heat of hands from the gage itself.

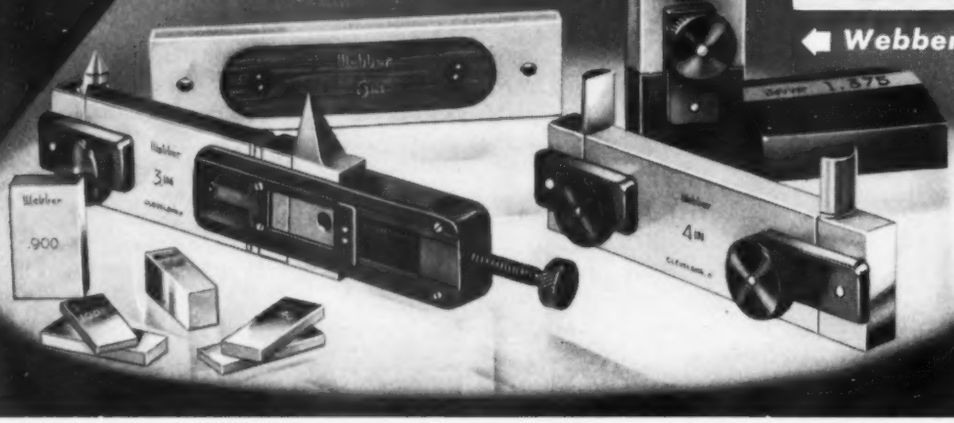
For a complete dependable gage block service use Webber Standard and Heavy Duty Gage Blocks.

Set No. 84A . . $350.00	Set No. 43A . . $185.00
Set No. 84B . . $235.00	Set No. 43B . $150.00
Set No. 38A (Thin Blocks) . . . $195.00	
Set No. 38B (Thin Blocks) . . . $155.00	
Set No. 14A (Angle Blocks) . $450.00	
Set No. H. D. 24 . . . $385.00	
Set No. H. D. 36 . . . $450.00	

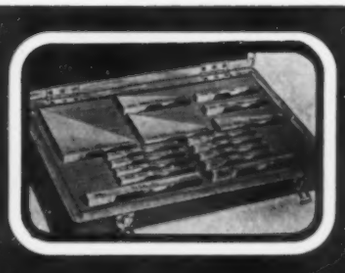
Webber Standard Gage Blocks



Webber Heavy Duty Gage Blocks



Full Descriptive Bulletins on both Standard and Heavy Duty Sets Available



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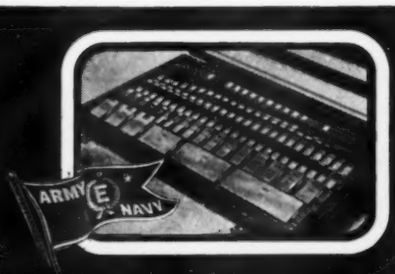


Step-Drilling Taper-Pin Holes—II

THE TABLE below lists taper pins in 21 sizes, ranging from 0.0625 to 1.523 in. in diameter at the large end. The *X* entries in the table below indicate the standard lengths of pins made in the sizes indicated. Sizes and dimensions not listed are special.

STANDARD TAPER PINS

No.	Length of taper pin in inches																								
	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5	5 1/4	5 1/2	5 3/4	6
7/0	X	X	X																							
6/0	X	X	X	X																						
5/0		X	X	X		X																				
4/0		X	X	X		X																				
3/0		X	X	X	X	X																				
2/0		X	X	X	X	X	X																			
0		X	X	X	X	X	X	X																		
1				X	X	X	X	X	X	X																
2				X	X	X	X	X	X	X	X	X														
3				X	X	X	X	X	X	X	X	X	X	X												
4						X	X	X	X	X	X	X	X	X												
5						X	X	X	X	X	X	X	X	X												
6							X	X	X	X	X	X	X	X	X	X	X	X								
7										X	X	X	X	X	X	X	X	X	X	X	X					
8										X	X	X	X	X	X	X	X	X	X	X	X	X	X			
9													X	X	X	X	X	X	X	X	X	X	X	X	X	X
10															X	X	X	X	X	X	X	X	X	X	X	X
11																										
12																										
13																										
14																										

Standard reamers available for pins to left of line
Sizes and dimension not listed are special

TAPER-PIN DIAMETERS AT LARGE END *

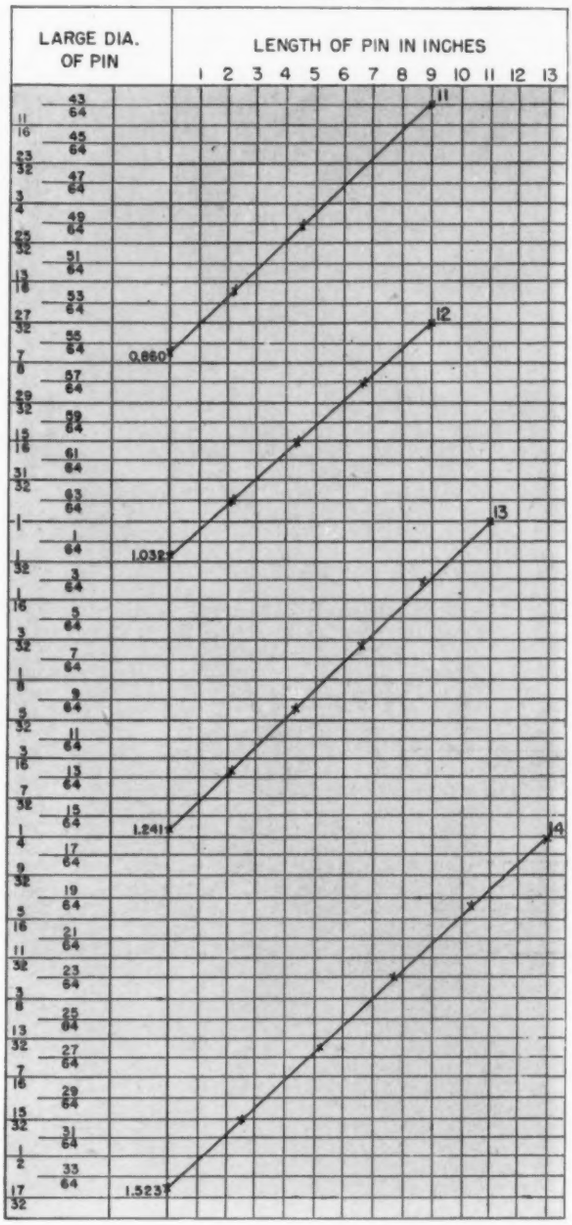
NO.	SIZE	NO.	SIZE	NO.	SIZE
7/0	0.0625	1	0.1720	8	0.4920
6/0	0.0780	2	0.1930	9	0.5910
5/0	0.0940	3	0.2190	10	0.7060
4/0	0.1090	4	0.2500	11	0.8600
3/0	0.1250	5	0.2890	12	1.032
2/0	0.1410	6	0.3410	13	1.241
0	0.1560	7	0.4090	14	1.523

* *To find small diameter of pin, multiply the length by 0.02083 and subtract the result from the large diameter*

TOLERANCES ON TAPER PINS

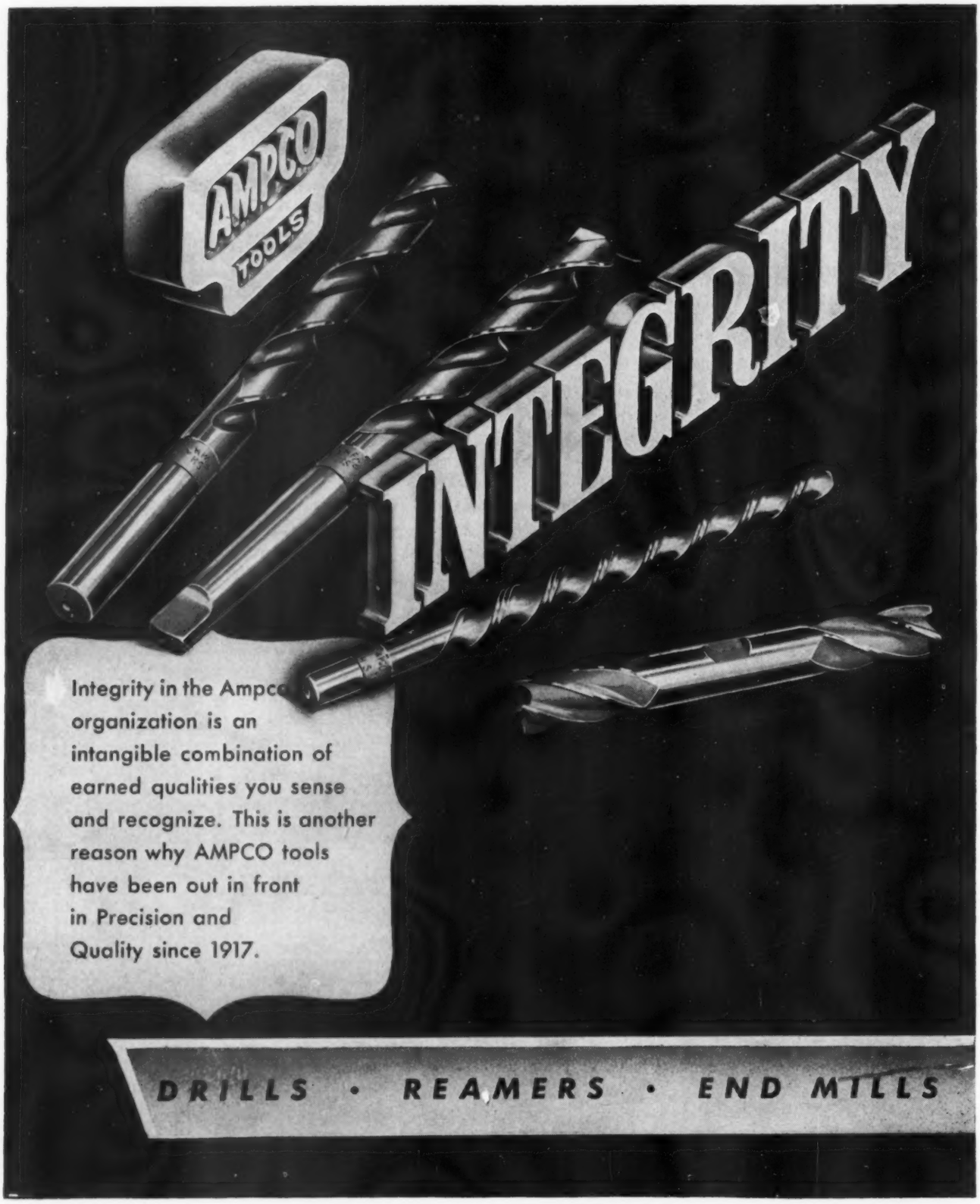
	Commercial type	Precision type
Sizes	7/0 to 14	7/0 to 10
Diameter	plus 0.0013, minus 0.0007	plus 0.0013, minus 0.0007
Taper	1/4 in. per ft.	1/4 in. per ft.
Length tolerance	plus or minus 0.030	plus or minus 0.030
Concavity tolerance	None	0.0005 up to 1" long 0.001 1 1/8 to 2" long 0.002 2 1/16" and longer

SEE DRILL CHART AT BOTTOM OF PAGE



DRILL CHART -- SIZE AND DEPTH

Pin size	First drill	Second drill	Third drill	Fourth drill	Fifth drill
11	43/64	23/32 x 6 3/4	49/64 x 4 1/2	13/16 x 2 1/4	
12	27/32	57/64 x 6 3/4	15/16 x 4 1/2	63/64 x 2 1/4	
13	1	1 3/64 x 8 3/4	1 3/32 x 6 3/4	1 9/64 x 4 1/2	1 3/16 x 2 1/4
14	1 1/4	1 19/64 x 10 1/2	1 23/64 x 7 3/4	1 13/32 x 5 1/4	1 15/32 x 2 3/4


AMPCO
TOOLS
INTEGRITY
Integrity in the Ampco organization is an intangible combination of earned qualities you sense and recognize. This is another reason why AMPCO tools have been out in front in Precision and Quality since 1917.
DRILLS • REAMERS • END MILLS

AMPCO TWIST DRILL COMPANY

FACTORY AND MAIN OFFICE
Jackson, Michigan

CHICAGO ☆ DETROIT ☆ PHILADELPHIA

NEWS OF METALWORKING

AUTO PARTS TROUBLES

Ford's criticism of parts suppliers as holding up auto production was met with surprise by many suppliers. In the Cleveland area, these firms contend that they are having almost as much trouble as Ford, if not more. Suppliers can't get all the castings and forgings they need, while steel shipments have not been at required levels. In addition, skilled labor shortages, and some declines in worker efficiency is blamed by some firms for the production drop.

In contrast to Ford's troubles, the General Motors suppliers have an entirely different headache. They don't know where to store the parts that they have continued to make under GM's express orders not to discontinue production during the strike. However, suppliers have now jammed warehouses and all available space at their own plants, and it is only a matter of time before they will have to stop production, unless GM can send them shipping orders to some other storage point.

NEW STAINLESS STEEL PEAK

It is estimated that over 500,000 tons of stainless steel were produced in 1945, setting a new record, and topping the 477,000 tons produced in 1944. About 40% of the nickel used by the steel industry went into the making of stainless. International Nickel Co. of Canada, Ltd., producing most of the world's nickel, says that 60% of its total refined output went to the American steel industry.

AUTO TOOL DELAYS

Some auto makers have been informed that tools they had expected to be delivered within three months will be delayed to seven or eight months due to castings bottlenecks and other production difficulties. The buyers are not too concerned over the delays, since they expect strikes at some point or other in the industry to interfere with production to such an extent that they will be able to get along without the new tools until mid-1946.

CHINESE IN COAST PLANTS

Some 69 young Chinese railroaders and engineers are studying practical methods for rebuilding their war-torn country by working in West Coast plants and railroads through a special arrangement between the U. S. and Chinese governments. Some of the engineers were culled from important posts in China's limited railroad and power systems.

PRESS BOTTLENECK SOLUTION

Badly bottlenecked press builders are resorting to various expedients to help increase production. They are farming out some of their production, and in addition have been using structural steel welded together in substitution for unavailable castings. The farming out of work to subcontractors reflects one of the widest postwar applications of subcontracting thus far.

NASH TRUCK PLANS

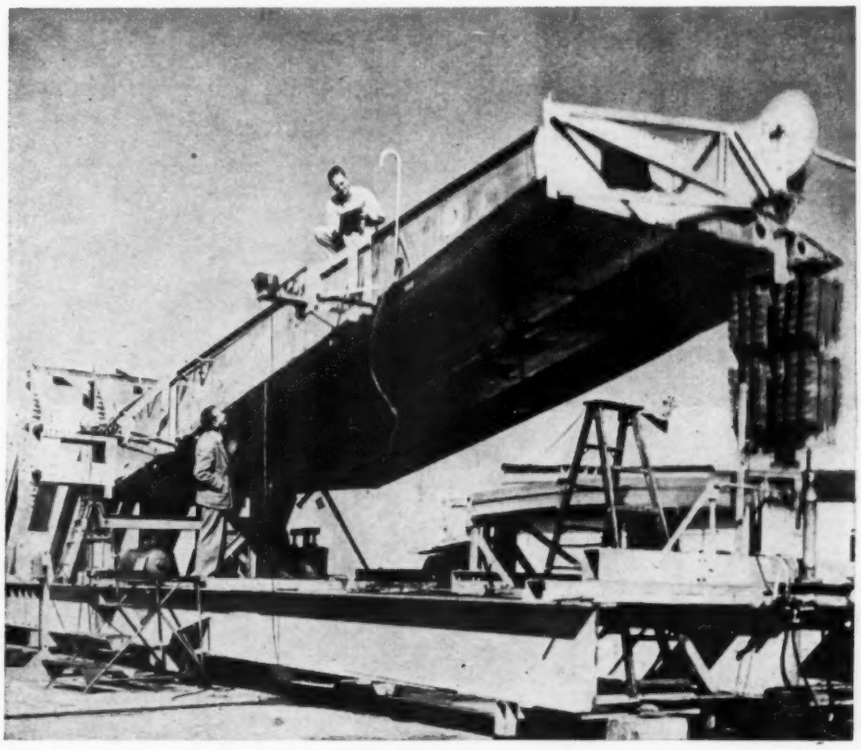
Nash plans three sizes of trucks to be in production about July, 1946: half-ton, three-quarter ton, and 1½-ton units. Nash's December production schedule called for 6,180 passenger cars, as against November's output of 3,180.

STEEL CAPACITY

The steel industry's capacity at the end of 1945 is set at 95,500,000 tons, of which about 7% is owned by the U. S. government, according to the American Iron & Steel Institute. Industry men say that all DPC-owned facilities will probably be taken over by the steel mills, provided that sales terms are satisfactory. Of course, the controversial Geneva and Fontana plants are not included in this expectation. Some 5,000,000 tons of the over-all capacity is expected to be abandoned or dismantled in the next few years.

SOUTH AFRICAN AUTO PLANTS

Port Elizabeth, South Africa, will have a new $1,600,000 Ford assembly plant, and a new $4,000,000 General Motors factory.



Flying An Airplane Wing On The Ground—A massive steel testing jig clamps securely a wing of the Lockheed Constellation as it is "flown" at a speed exceeding 300 miles an hour. A heavy off-center wheel at the wing tip rotates rapidly and causes the wing to vibrate in the same way as it does while flying. Dozens of tiny electronic gauges record minute stresses and strains

Gaging Business

Steel Strike Threat

Unless the impending industry-wide steel strike is averted, it is expected that the nation's major industries will be paralyzed by lack of steel by two weeks' time from the January 14th strike starting date. The auto industry is believed to be in a position to get along without further steel shipments for two weeks, but manufacturers of other types of consumers' durable goods may shut down a lot sooner.

The reason for the particular vulnerability of heavy industries to a general steel strike is that industry has not been able to accumulate any inventories since the end of the war. It takes about two months' output of steel to fill up the manufacturing production lines and to supply working inventories. Besides work-in-process and working inventories, many manufacturers lay in anywhere from two weeks to one month's reserve inventory. Although some war types of steel were usable for civilian type production, this factor has been offset by the high rate at which industry, when able to operate, has used all available steel to meet heavy consumer demands. Thus, accumulations in September, November and December have been very slight.

General Motors the Key

Industry is generally watching the outcome of the General Motors strike, since it is expected to lay down the formula for similar wage increases in many other industries. But in the meantime, many small plants are being hit by strikes or slowdowns, and they hesitate to settle on wage increases before GM makes its decision.

Some labor observers question the strategy of the CIO Steel Workers in planning to call a strike on January 14th, right on the heels of the GM strike. It is argued that there would be little incentive for General Motors to settle its strike with the CIO if it faced the possibility that it would have to be shut down shortly afterwards because of interruption of steel deliveries.

The inability of Congress to act fast enough to avert the steel strike leads some insiders to believe that the White House will be forced to act to keep industry's wheels turning.

Fact-Finding Views—President Truman's fact-finding plan for checking strikes has met with much opposition, some support. Secretary of Labor, Lewis B. Schwellenbach (left), testified before the Senate Labor Committee in favor of the proposal, but AFL president, William Green (right), opposed the plan in his testimony. However, little hope is held that this idea will stave off the impending steel strike.

Press Bottlenecks

The continued bottleneck in presses, with some builders loaded up for 15 months is expected to hamper industrial production. About 40% of press business on the books is reported from the auto industry, with the balance coming from canners, stove and washing machine producers and similar plants.

Press brakes and shears are almost as tight as presses. The backlogs of some press brake and shear manufacturers extend some 8 months.

Ureven Machine Backlogs

Though the machine tool industry has a backlog of $170,000,000 of unfilled orders, and monthly output is down to $25,000,000, the situation ahead is not as favorable as it seems. Some companies have nine to ten months' orders on their books, whereas others can make two or three months' delivery. Many companies are short of skilled help in their engineering departments, to the extent that acceptance of new orders is limited by this factor. Besides this, production is hampered by the inadequate supply of castings, motors and bearings.

Two factors are militating against the placing of new machine tool orders. One is the bad labor situation in the automotive industry, normally the biggest source of domestic business. The other is the slow action by Washington agencies in providing arrangements for foreign customers. General Motors has halted the making of further commitments for machine tools until its strike ends. Other motor car makers are very cautious about buying machines. One surprise has been the liberal amount of business done in standard general purpose machines, such as lathes, milling machines and planers. It is partly accounted for by the difficulty up to now of getting desirable surplus machines owned by the government. Only 60,000 of some 650,000 machine tools owned by federal agencies have thus far been declared surplus. From now on, however, surpluses are expected to become an increasing threat to new machine tool sales.

Machine tool shipments for 1945 are roughly estimated at $405,000,000, compared with $497,464,000 in 1944 and the wartime peak of $1,321,748,000 in 1942. Sales for 1946 are conservatively put at $250,000,000 as against $189,000,000 in 1937, the best prewar year. They may even be higher. November's output was $25,900,000, a considerable decline from October's $31,100,000. New orders in November totaled $23,800,000, not too far under the October level of $26,300,000.

Steel Strike Inevitable; Order Books Jammed; Foreign Needs Critical

PITTSBURGH—The major portion of the steel industry is now committed to a belief that a steel strike, set for January 14, hardly is likely to be headed off. The only possible means of preventing a walkout is a price increase and this seems unlikely.

The OPA wants the steel industry to expedite its fourth quarter financial reports so the price structure might be reviewed again. Steel officials snort at this, pointing out that preliminary reports are never available before the third week of January and, in 1946, the steel industry appears destined to be on strike before that.

Meanwhile, price developments have other angles. The government agency indicated to the smaller steel producers that it was willing to exempt them from price regulations and it also appeared to be willing to approve a revised schedule of extras for the industry as a whole; the latter development, of course, would produce an over-all increase in realization to the steel companies.

Small Firms Distressed

The smaller steel firms promptly voted down the proposal for exemption from price controls, although some of them favored the plan. Officials of the smaller companies said this plan was voted down because they would suffer when conditions return to normal if they charged what they liked for their steel now. They denied their vote was tied in with the problem they are facing in respect to their steel supplies—many of them are non-integrated companies — but they are vitally concerned with the latter factor. Some, at this writing, have been shut off altogether because supplying mills claimed they were losing money on the semi-finished steel and it was because some of this smaller group went to Washington and asked that semi-finished be allocated to them by the CPA that all the talk about steel allocations has come to the fore again. According to reports, the CPA is said to have pleaded inability to return to the allocation system because of its manpower problem and somwhere it was suggested that a committee to be named by the American Iron and Steel Institute be formed to allocate steel supplies. By this time the allocation problem had developed into a major project, suggestions extending the proposal to include consumers of finished steel as well who now are placing every form of pressure possible upon mills to ship them tonnage before the steel strike starts.

It does no good to attempt to get an order on the books now, for no new orders can be filled before the middle of January.

Fuel was added to the fire surrounding the price question by a Government request for upwards of 1,500,000 tons of steel for UNRRA. This was specifically not lend-lease. The complication arose because exporting agencies were set for a 10 per cent commission from the mills on the business and the mills balked. The types of products desired for use in Europe, and their destination, were not immediately learned.

Foreign Needs Unfilled

With heavy pressure for material from domestic sources, it was difficult to ascertain how any export business of size could be provided even should financial arrangements be satisfactory. There were even reports that the requests or allocations for foreign use might be larger than the tonnage earmarked for relief.

PLATINUM USES REACH NEW HIGH IN 1945

NEWARK, N. J.—It is estimated that some 275,000 ounces of platinum were used in 1945, about 90% of which went for electrical and industrial uses. In addition, some 150,000 ounces of palladium were used of which about 40% went for industrial uses.

With the prospect of a steel strike not far distant, there arises the question of the condition of stocks in the hands of consuming industries. Because revival of peacetime production has been delayed for various reasons, but chiefly by strikes, stocks of steel on hand are improved over what they were a month or so ago.

Production of ingots has been stationary here for five weeks. Manpower is still the chief deterrent to a higher rate of production.

Two-Month Machinists' Strike Hits 200 West Coast Plants; 60,000 Idle

SAN FRANCISCO—Industrial warfare, declared last October 29, when the machinist unions in the San Francisco Bay Area struck for 30% higher wages, is now in the trenches with both sides holed up—apparently with intentions to sit out the winter. No signs of weakening by either side can be observed, with attempts to bring about peace via bargaining but a slight possibility.

The striking machinists, said to number about 10,000 are composed mainly of AFL Lodge 68 on the San Francisco side of the Bay, and CIO Local 1304 across the bridge in Oakland. Their ultimatum of "30%" excludes all efforts of employers to mediate. The unions want their demands met "or else." In the opening days of the battle, a few of the struck plants offered 10% raises, which fell on deaf ears.

No Strike Vote

The strike was born under shady circumstances as union leaders ignored the NLRB, thus avoiding any strike vote and the 30-day cooling-off period. This has put the strikers in an unfavorable light with California officials handling unemployment insurance, and thousands of applications are being refused. The loss of wages is estimated to run well over the $20,000,000 mark.

But the 10,000 struck machinists have caused the idleness of 60,000 workers in the 200 struck plants. One good example of this is at Paraffine Products, where 60 machinists are employed but are backed up by 1,200 other employees. There have been a few attempts to force the lines. Main point of violence has been at Bethlehem's Alameda Shipyards where a few fists flew, as returned veterans who wanted to work talked about the principles of freedom they were supposed to have been fighting for.

Wages Already High

The wage rates under fire are among the highest in the nation, which prevents the OPA from entering the picture, as employers claim higher prices for their products would throw more favor on Eastern competitors than they could stand. An example of this is the rate for tool and die maker, currently at $1.53 (as against $1.25 on January 1, 1941), yet the union is demanding $2 an hour.

With production at a standstill, large backlogs of semi-processed goods are becoming larger, while raw materials are piling up in warehouses and on docks, with employers showing a small amount of concern that they will eventually be shunted out of the territory to fill competitors' orders.

Steel Strike Effects

Manufacturers are looking with a wary eye at the steel strike. Supplies are already low in the west and should they not be replenished, the future might hold a prospect of many shutdowns due to lack of materials.

West Coast Industries Concerned Over High Wages, Price Competition

LOS ANGELES—Conversion and reconversion is progressing steadily, if not rapidly, in Southern California metalworking plants, and with few major obstacles, but numerous minor ones, impeding the change-over. Strikes and strike-threats have been negligible, but management is reported uneasy about the long-range attitude of personnel when the competitive situation tightens.

With the possible exception of some kinds of steel, allocations of which have been criticized, materials appear to be adequate for current, small volume production. That they will be available in greater quantities as production volume mounts, seems fairly certain.

Equipment Adequate

Machines and tools, likewise, are causing no major difficulties. But personnel to operate and use them is another matter. Apparently there are still many thousands of metal workers taking vacations, looking around, and using up their unemployment compensation. State agencies report a steady increase in compensation applications in this area.

Chief among numerous causes of the current labor shortage is said to be the lack of a stabilized national policy on wage increases. Some new contracts have been signed recently calling for increases of eight and ten percent. Wage rates, however, have been from five to thirty percent higher, job for job, than those in other parts of the country, which explains acceptance of lower postwar increases.

It is this higher scale that is causing most of the long-range worries of management in the metalworking plants in Southern California. Until recently, costs were not the controlling factor they become in peace-time competition, so higher scales were an advantage, in that they attracted metal workers to Southern California plants.

Labor Trouble Ahead

Now, with wages and prices yet to be stabilized, and competition taking the form of a race for dealers and markets, the higher local scales do not figure too prominently in contract arrangements. They usually count very little on new items, and only slightly on work absorbed in plant conversion, where promise of speedy delivery is the principal requirement to obtaining orders.

But when the transition period honeymoon is over, and price competition becomes keener, what is going to happen to Southern California plants faced with long-accepted higher pay scales? Some of the margin can be absorbed via greater production efficiency, lower plant construction and operational costs. Some through the transportation cost handicap Eastern and Middle Western goods must bear. But if these are not enough to overcome all of the wage differential, what then? Will labor accept the facts and make necessary wage concessions? These are questions worrying management.

Strike Votes Beaten

That strikes and strike votes are losing their early postwar lustre seems indicated by two recent happenings. At one Los Angeles plant (Harvey Machine Co.) strike vote petitions have been withdrawn by the union (CIO), because it was opposed by the membership. Another vote, insisted upon by NLRB, and union leadership (CIO), despite membership opposition, was voted down by a 2½ to 1 margin. (Byron Jackson Co.)

New contracts for aircraft, both military and civil, have reduced layoffs in most of the aircraft plants, where the help wanted signs are again out, particularly for engineering and production personnel. Shipyards, too, are seeking workers, largely for repair jobs now on the increase.

Western Agencies

Another trend, indicated by frequent local announcements of signed contracts, is turning Southern California plants, many born during the war, to manufacture of such items as washing machines, radios, and refrigerators of nationally known makes for distribution by parent company's sales organization in the West.

One nationally known appliance concern (Bendix) is getting into production at a new plant near Los Angeles (Ontario, Calif.) on thirty percent of its national volume, for its Western distribution. Another Middle Western concern (Hurley) has just announced contracting for manufacture of Western volume of its washing machines and other household machines in a Los Angeles plant. And there are numerous other, similar instances of such arrangements, all of which will, it is hoped, keep Southern California metalworking plants busy.

Dealers Handling Australian Surplus Tools at 28½% Discount From Value

SYDNEY, AUSTRALIA—The Commonwealth Government has been working on a plan for the disposal of surplus machine tools. Such tools fall in two categories: (a) American lend-lease tools; and (b) all other tools. Thus far, no settlement on lend-lease tools to Australia has been made, and it would not be a surprise here if the United States withdrew such items and sold them in some other market, such as France.

So far as all other tools are concerned, disposal is being handled through Panels (committees) consisting of representatives of machine tool builders in Australia. There is a top Federal Panel, and each area has its own State Panel.

Formula Price Discarded

At the outset, the Commonwealth Government adopted a formula for arriving at the selling price, similar to those used in the United States and the United Kingdom. However, this was found unworkable, and a system of valuation was developed by which all tools are inspected and valued by a government representative selected from the tool industry.

Once a fair market value has been set, the tools may be purchased from the government at a 28½% rebate from that price, out of which the dealer handling them has to pay the cost of removing the machines from their location to a point of storage pending sale. In addition, the dealer has to pay the government within 7 days after making his purchase, but he must buy quickly generally before he is able to resell the tool. Available tools are announced from time to time, but must be bought within a limited period. As a result, the dealer's purchases are largely on speculation and may accumulate unsold.

The Government is giving dealers the opportunity of handling all surplus tools, beyond those required for commercial use immediately and for export. However, if they do not absorb the tools offered from time to time, then the Government may elect to sell the machines in question by auction or otherwise.

Priority On Own Lines

Each dealer will get a priority on the types of machines they are agents for, which appeals to the dealers as a very sound arrangement. It will give them an opportunity of keeping track of their machines and thus insuring that they will be kept serviceable.

Although only a few lists of available machines have been issued thus far, these indicated few machines which dealers could readily handle. Despite this, dealers are supporting the Government's program, since they realize that if the surpluses were dumped at auction it would damage the new equipment market. The lifting of wartime controls on new equipment is reported to have stimulated inquiries by buyers.

Detroit Letter

Strike Showdown Seen

Despite President Truman's fact-finding board and the promised cooperation of both the UAW and General Motors, the bitter battle between labor and management appears to be headed for the long route.

This was emphasized in the corporation's demands, served on the union at the last meeting before both went to the capital and the fact-finding board. GM's list of 11 points which outline the proposed new contract assailed the very citadel of unionism, the maintenance of membership clause, which the company claimed was saddled on it unjustly by the War Labor Board in 1942.

In the new contract, GM wants the union "to recognize the rights of employes and applicants for employment to elect or refuse membership in any union, to maintain or resign from such membership, to enjoy freedom from restraint and discrimination, coercion with respect to work, employment, union membership and union activity." Solicitation for union membership and collection of dues shall not take place during working hours on company time or company expense.

Union Responsibility Asked

Going a step farther and following the lead taken by the Ford Co., GM demands individual union responsibility in the new contract. Its No. 7 point is: "That there be appropriate penalties, including loss of seniority, against any employee taking part in any strike or work stoppage in violation of the agreement."

Then it adds a new clause. Ever since the union was recognized, union publications have been a thorn in the side of management. GM in particular has yelled loud and long about "vilification" of its top officials by UAW writers and cartoonists.

Union Vilification Fought

One of the most irritating factors in the present wage discussions was the revelation by Walter P. Reuther, UAW strike leader, to a weekly magazine of the stenographic notes taken at GM-UAW discussions, quoting Harry B. Coen, GM's director of labor relations, verbatim in all his picturesque language. So here is the clause which GM wants in the next contract:

"That there be an adequate guarantee that the union will make good its pledge to eliminate personal attacks, false accusations and vilification of management through official union publications, handbills, literature and releases."

Incentive Pay Aspects

Two other new clauses have been added to the proposals. One would ask the international union to remove all its objections to incentive pay. The other would give returning veterans with no seniority in GM plants equal seniority with civilians.

Among other reforms the company wants in its new contract with the union are well defined rights of management; a sharing of the costs by the union of committeemen handling grievances or other negotiations; simplification and speeding up of grievance procedure.

80-Cent Base Pay

One of the interesting offers made by the company is to set the floor for all employees, male and female, at 80 cents an hour with a raise to 90 cents in six months. This would include the 13½ cents per hour offered by the company already to the strikers.

It would equalize for the first time rates paid women and, outside of the Detroit area, would raise basic wages considerably. It might mean an increase of 20 to 25 cents an hour in some locales.

Ford's Offer

The long awaited Ford offer was made a short time ago. It would give an increase of 12½% to all of the company's 80,000 workers, but it was immediately termed unacceptable as GM's 13½ cent an hour bid for peace had been. The quick rejection indicated that as much as the UAW wants to keep working at Ford while GM is tied up, its aim is much higher than 12½% or even 15%.

The offer amounted to about 15 cents an hour and meant $33,000,000 a year added to the annual pay roll. The offer was somewhat conditional and was predicated on increased production. It would become effective at the end of any month in which total Ford production reached 80,000 units. The unit total would be composed of Ford, Mercury and Lincoln autos and Ford trucks. Highest unit production at Ford since the end of the war, has been 22,508 reached in November.

In return for the raise the company asked a security clause of its own. It demanded an end to work stoppages, increased management prerogatives.

General Motors Officials Ponder Weighty Decision—Major industries hit by strikes or facing potential shut-downs watch negotiations between the CIO-UAW and General Motors. Top GM officials engaged in discussions are C. E. Wilson, president (right) and H. W. Anderson, vice-president

British Tool Industry's Postwar Plans

By William J. Hargest

European Correspondent

LONDON—The British tool industry has formulated its postwar plans, via the British Machine Tool Trades Association, and has proposed a joint advisory council made up of tool builders and government officials to back up this program. The proposal would assure the industry of a higher level of operations than postwar, larger exports, production of tools seldom built in Britain previously, restrictions on surplus sales, and the holding of frequent exhibitions to stimulate sales.

The BMTTA feels that postwar tool output should be held to at least $100,000,000 annually, as against the 1943 peak of $186,000,000, and current levels of around $86,400,000 annually. Such production is believed to be adequate for the normal demands of British industry, to enlarge exports, and to aid national defense.

Huge Expansion

The British industry was much smaller pre-war—1935 shipments totaled $24,000,000, of which one-third was exported. The average age of tools in British plants pre-war was over twenty years. In 1938, shipments, including some non-tool items, totaled $56,000,000. The war caused the industry to more than double in size; of the $186,000,000 shipped in 1943, 75 percent or $139,000,000 came from established tool companies, with the balance turned out by subcontractors.

The industry feels that it would be dangerous if annual output were allowed to sink below $100,000,000, since it would not permit a vast modernization of British industry, expanded exports, and maintain the industry in a position to meet emergency defense requirements. The industry feels that tax legislation should be revised to allow for faster depreciation than the present 20-year average provided by law.

50% Export Target

Although the export target has been set at 50% of total output, in late November, the actual volume was only 25%. The industry thinks that the Export Credits Guarantee Department of the Board of Trade should adopt a bolder policy in extending credit on tool exports. Because of the existing attitude, most tool builders have financed their own exports.

The association believes that periodical machine tool shows should be held in London to stimulate domestic and foreign sales of British tools.

Builders believe that the 20% duty against foreign tools imported into Britain could be eliminated if such items could not be secured from the British industry. This contention is held even though American duties in the past have been so prohibitive that British tool builders were excluded from the U.S. market. The British are willing to permit equipment imports under the same conditions that are extended to British imports in various nations. Despite the current shortage of dollar exchange, which has virtually banned imports of American equipment, British builders think that the dollars involved should be released, if by importing such tools, British exports of manufactured products would actually be increased.

More Types Produced

The association, in conjunction with the Ministry of Production's Machine Tool Control, recently prepared a list of machines which were produced in Britain prewar in limited numbers, and then only at a financial loss. The reason was that British demand did not support mass production of such machines, so that it was more economical to import them. The British feel that an assured volume of business will enable them to produce any of these tools: automatic form-turning lathes, crankshaft and camshaft turning lathes, special milling machines, die-sinking machines, special broaching machines, superfinishing machines, automatic bolt-makers, internal centerless grinders, precision boring machines, multi-spindle automatic lathes, boring machines, bevel gear generators, watchmakers lathes.

The association feels that the government should assure the sale of a certain volume of these tools, and offer other forms of encouragement to their producers, perhaps to the extent of curtailing imports when necessary. In addition, it is suggested that pilot munitions factories be established to develop armament tools. In addition, it is proposed that builders of special tools collaborate with foreign tool builders.

Scrapping Surplus Tools

With respect to surplus tools, the association recommends: (1) that the disposal rate of surplus tools be regulated whenever such sales jeopardize the sale of new tools; (2) that a vigorous policy of scrapping be continued, and that the government on its machines condemned to be scrapped to make sure that they are actually broken up; (3) refusal to sell used machines for stock should be continued.

Dr. Briggs Tells Standards Group Of Wartime Advances in Science

NEW YORK—The annual meeting of the American Standards Association was addressed by Dr. Lyman J. Briggs, until recently Director of the Bureau of Standards. Dr. Briggs' subject was the impact of the war on science. He pointed out the marked acceleration in scientific progress stimulated by the urgent necessity of war needs. He also stressed the necessity for continuing in research by government and by industry.

Dr. Briggs was introduced by Henry B. Bryans, executive vice president, the Philadelphia Electric Company, who was re-elected to serve a third term as president of the American Standards Association. Frederik R. Lack, vice-president, the Radio Division, Western Electric Co. was elected vice president. Other officers announced at the annual meeting are E. C. Crittenden, assistant director of the National Bureau of Standards, as chairman of the Standards Council, and L. F. Adams, General Electric Co., as vice chairman.

Mr. Bryans traced the Association's activity in his annual address and pointed to the fine cooperation between government and private enterprise which made the ground work for war production. He told something of future plans for the association and the larger responsibilities that it must assume.

Standards For War

As retiring chairman of the ASA Standards Council, Dr. H. S. Osborne, chief engineer, American Telephone and Telegraph Co., stated that 85 percent of the standards adopted by the A.S.A. in the past year were directly connected with the war effort. Dr. Osborne analyzed the activities of the association's past 12 months and predicted that the A.S.A. will continue to increase in helpfulness to industry and government. The meeting was held on December 7.

Lincoln Electric Founder Honored on 50th Anniversary

CLEVELAND—James Cromwell Lincoln, founder of the Lincoln Electric Co., was presented with a silver plaque on December 5 by his employees to mark the fiftieth anniversary of the company. Now chairman of the board, Mr. Lincoln has seen his firm grow from one with a capitalization of $150, to its present position as the largest producer of electric arc welding equipment.

Washington Bulletin

War Assets Corp.

Sam H. Husbands, RFC Director, will be chairman of the new War Assets Corp., created by RFC to handle war surplus sales. Other members of the board will be three men from RFC and two from Surplus Property Administration. WAC was organized to carry the burdens and troubles of surplus disposal and especially to keep it clear of RFC's dignified banking business.

RFC now has the main parts of surplus sales on its hands, a job it didn't ask for and doesn't like, and is increasingly resentful of instructions from the policy-making SPA. W. Stuart Symington, SPA chairman, has made up his mind not to wait upon the slow motions of congress for amendments to the Surplus Property Act, but to make the best of it as it is.

Symington is going ahead because he knows that surplus can be moved now, if ever, while many surplus items are in short civilian supply. As soon as reconverted industry puts its goods on the market, the demand for surplus will slacken, and industry will bring pressure to freeze surplus in favor of new products. At the same time, it should be noted that a vast quantity of government surplus, such as combat airplanes, is unsalable. This adds to SPA's and RFC's difficulties, and partly explains why the surplus cash register only shows a half billion dollars in sales, against total surplus declarations of nearly ten billions.

RFC-SPA Differences

Since RFC now has the bulk of surplus goods for sale, there is less reason than ever for a separate policy-making agency (SPA). RFC is beginning to feel that, since it does the work and gets the experience, it might as well make its own policy. To some extent, it is doing just that. As a result, conflict is simmering to a boil.

Unless the SPA-RFC combination begins to move goods into use pretty soon, a blowup is inevitable. The outcome is unpredictable. Inevitably, congress will take a hand in a surplus disposal reorganization, if not in a full-dress investigation.

OPA Machine Prices

OPA's new revision of age and condition requirements governing sales of used machine tools applies to all, whether sold by RFC or private owners. But RFC's Clayton formula, recently effective on the basis of age, sets up lower prices than does OPA, and will govern RFC sales.

OPA's order, effective December 22, prices second hand machine tools on a scale which automatically lowers the ceilings as the tools grow older. Until now, the prices were based on date of manufacture and condition, making no provision for increasing age.

If the tool is no more than four years old, the price if rebuilt and guaranteed is 95% of the price when new; if sold in any other condition such as "as is," 70% of the new price. Between age four and ten years, the ceiling is 85% if rebuilt and guaranteed, and 60% in other condition. Between 10 and 15 years, 80% and 55%, respectively; between 15 and 20 years, 70% and 45%, respectively; 20 years and older, 60% and 35%, respectively.

These revised qualifications preserve the previously established differential of 25% between prices for rebuilt and guaranteed and "as is" equipment. Principal application of the OPA schedule is on older machines being sold by owners who are buying newer ones from RFC.

1946 Plane Output

U.S. aircraft output is expected to drop below one billion dollars in 1946, or about six percent of peak annual output of 16 billion dollars during wartime. Although this is nearly triple the prewar volume of about one-quarter billion, scored in 1939, it will not be enough to support research programs that will be essential to maintain U.S. aviation supremacy.

In contrast to this prospect, aviation experts know that research costs will go up if we are to keep in the forefront of developments in jet, gas turbine and rocket propulsion principles in aviation. The industry should be aided by the Air Coordinating Committee of the Army, Navy and the Department of Commerce which has recommended a minimum annual output of 3,000 to 5,704 military planes as a base for potential expansion in the event of an emergency. In 1939, 2,141 military planes were produced.

STRIKES HIT AID TO FOREIGN NATIONS, TOO!

WASHINGTON—Generally overlooked, but very important in the postwar world, is the damaging effect that strikes are having upon our ability to aid the rest of the world rehabilitate itself. Despite our loans to various nations, those countries are and have been unable to buy here the various things they need. Right now there is a heavy European demand for steel. Recently, CPA cut European needs down from 4,000,000 tons to 800,000 tons. Now it is reported that UNRRA needs 1,000,000 tons. The question that foreign observers ask is how we are going to be able to export any steel, if our industry, hard pressed by domestic demands, will soon be struck down by a strike?

British Auto Industry Makes Hay—While the American auto industry is held at low gear due to strike difficulties, British car makers are already exporting postwar cars. The shipment shown here of Austin cars is destined for New Zealand. The new U.S.-British trade agreement may enable American cars to get into more British markets

Many Cleveland Firms Diversifying Activities to Hold Up Sales Volume

CLEVELAND—As could be expected, many of the machine tool builders and metal working shops in Cleveland have worked and are working toward diversification of products.

Those which are more advanced and are ready with new products now, such as Warner & Swasey, Pal-Vin Machine & Mfg. Co., Sommers & Adams and a few others, had the germ of the idea for their present new machines, tools and products on the drawing boards long before the war started. Others now faced with the necessity of finding something to manufacture and sell are getting well along with the preliminary work, and actual production can be expected within the next few months.

Warner & Swasey Items

Warner & Swasey only recently confirmed the news leak that they were more than a little interested in getting into the building of certain types of textile machines. One machine, a gill box, has been given its try-out. Later confirmed by Warner & Swasey was the building for a large textile corporation a machine of new design for the synthetic fiber field. Also, it became known that longtime negotiations between Warner & Swasey officials and the inventors of a revolutionary type loom, Swiss owned, were almost completed.

Back in their own field the company will be ready with a formal announcement to be made soon after January 1st of their entrance into the field of producing chucks. Present plans call for the company to concentrate on chucks for their own machines, Seeing the need for an automatic bar machine to round out the field, Warner & Swasey came up with their new five-spindle automatic bar machine only within the past month.

New Type Motor

The Pal-Vin Machine & Mfg. Co., which before the war was principally concerned with doing custom machine shop work, has announced a new type gasoline motor which utilizes a cam with an harmonic motion curve as a crankshaft. Cutting the groove into the cam was the difficult part of the job, company officials said, so that company will soon announce a new cam-milling machine.

Sommers & Adams, for years before the war one of the prime suppliers of jigs and fixtures principally for the automobile builders, but with a side step occasionally into the special tool building field, have gone in for diversification in a major way. The new circular indexing machine with electronic controls for each of the six positions, is finding ready acceptance by manufacturers who can make use of such a complicated machine. Another product is a motor of radical design, operating on either gas or diesel principle, and in which some of the largest industrial companies in the country are interested.

Foote-Burt Co. finds itself deluged with orders from the automobile and refrigeration industry, for its special tools.

Hecker to Make Pumps

The A. W. Hecker Co., a company which has always specialized in building special machine tools, is entering the pump field, erecting an addition to the present factory for this new product. And, other new products are well past the drawing board stage.

National Tool Co., on the other hand, which had been studying fields other than machine tools for future products, finds itself back producing grinders and kindred standard type tools in volume which has a pleasant relation to that of the mid-war years. Long a supplier of tools for Russia, the company is again being favored with orders from this source.

Others Don't Change

Cleveland Punch & Shear found the end of the war giving the company the opportunity of getting back into turning out their regular line of products, and had no reason to look around for new fields to enter.

Another company happy to return to its peacetime products was the recently sold Cleveland Pneumatic Tool Co. The company has given a definite "no" to the government on buying the DPC plant operated during the war in turning out airplane parts.

National Acme Co., says president F. H. Chapin, is more concerned right now in working out from under the backlog of orders than in announcing any of the new products which have been rumored for that company. With sufficient orders on hand to keep the machine tool building section busy until November, 1946, the chief worries right now are parts and supplies.

New Postwar Trailer—Weighing about half as much as comparable prewar models, the Aero Flite trailer is now being turned out by the Aero Services Co., Los Angeles. The light-weight unit shown, utilizing considerable amounts of plastics, aluminum and magnesium, will sell around $2,500 each. The entire 1946 output of the model is already sold out

NEW CONSTRUCTION

B. F. Goodrich Co., is planning to construct a $4,000,000 plant near Marietta, Ohio.

The **Bennett Manufacturing Co., Inc.,** Alden, N. Y., has started its expansion program to spend $60,000 for new machinery and equipment.

Westinghouse Electric Corp. plans to purchase the **Curtiss-Wright Corp.'s** Cheektowaga, N. Y., plant for $9,600,000 from RFC to house the electric motors division, which will be transferred from East Pittsburgh.

International Harvester Co. of Canada, Ltd., has approved a $5,000,000 building program at Hamilton and Chatham, Ont. A new motor plant will be erected in Chatham during this year, while more than $1,000,000 will be devoted to modernizing the gray-iron foundry at Hamilton, where a new heat unit will be erected.

Hydro-Power, Inc., has chosen Springfield, Ohio, for the site of its new factory. The building is now under construction and production is expected to start in February.

Bendix Aviation Corp. plans to spend approximately $25,000,000 for the purchase and modernization of facilities.

Tool Builders and Dealers Apply For RFC Licenses to Sell Surplus

CLEVELAND—All leading tool dealers in this area are applying for licenses to handle surplus equipment through the RFC at the 12½% commission plan recently announced. Moreover, some tool builders are also joining up. Neither the dealers nor the builders are too keen about handling surplus tools, but realize that it is in their best interests to join in this activity.

Tool builders, including such firms as National Acme and Erie Foundry, feel that they can help protect their reputations by trying to handle as much of their own products included in surplus as possible. By proper reconditioning and inspection by the original builders, it is felt that the buyers will be protected and get better value for their money.

Tool dealers don't like the idea of handling surplus tools at a small cash commission, but they feel a responsibility to their own lines, and also to their customers which might require surplus items in a pinch.

New York Interest Low

NEW YORK—Established dealers in new equipment are not very excited over the SPA's dealership plan for handling surplus tools. They will generally apply for dealership rights, since it will probably help them to service their customers in a pinch. However, some of them plan to stick to relatively new government equipment to avoid difficulties. All dealers realize that handling surplus government equipment will involve a lot more work than handling sales of new items from their regular lines.

Even though used machinery dealers will naturally go along with the arrangement, their incentive to work on government sales is not as great as might be imagined at first. They generally make from 30-50% on privately-owned used equipment, in contrast to the government offer of 12½% on surplus equipment.

General reaction is that the commission is too low. It's a low rate on low prices. However, it is reported that SPA opposed granting the higher rate the RFC had originally proposed.

Simmons Cites Handicaps

NEW YORK—Red tape was named as a major handicap hampering sales of surplus equipment through recognized machinery dealers, according to Charles A. Simmons, President, Simmons Machine Tool Corp., Albany, N. Y. Mr. Simmons stated, "When a machinery house takes on an agency with a manufacturer, it has definite plans to follow, whereas in dealing with the RFC such is next to impossible. A great amount of this government machinery already is in warehouses and eventually all of it will be removed from users' plants and warehouses. Most of this machinery has been processed, covered with a black slush and wrapped in paper, in short, difficult conditions under which to inspect a product.

Poor RFC Descriptions

"Another disagreeable condition surrounds factual representation of this machinery. The RFC warrants the accuracy of the description of the machine, but experience has proved that their descriptions are extremely inaccurate. This is certain to lead to complications. Furthermore, after a machine is warranted as new the RFC guarantees its condition as new. However, a new machine subjected to the elements can be rusted to such an extent that it is comparable only to a good used machine.

"Another complicating factor arises when the RFC finds it has been negotiating with a prospect at the same time that a dealer makes a sale to him. The dealer is liable to be disqualified and not given sales credit.

"Above all, there is no means at present of contacting anyone connected with the RFC who can give you a definite price on anything they have to offer. It generally takes weeks. When we purchase from the RFC we do not get the machine complete and in some cases have received the wrong machine. In other cases the machine we purchased has been lost and our check has been returned. All of these complications will tend to handicap dealer disposal of government equipment. There is no way, we have found, of ascertaining from any of the RFC surplus lists of machinery what they have to offer, an intelligent description or price.

Actual Age Factor

"As the selling price is predicated on the time the machine has been in actual use and, therefore, the price is figured according to the Clayton Formula, what is to happen as time goes on and machines become older and in many cases are subject to the elements? The only reasonable way to price this machinery would be to figure the age from the time it left the factory, regardless of whether it has been processed.

"I might add that as long as RFC has gone to the extent of being willing to pay the dealers a commission on the sale of this machinery they could go one important step further: Secure the services of the dealer to write up an intelligent description of the machinery for sale and establish at the same time a selling price."

Dr. Hu, Founder of China Motors Takes Ranger Plant

NEW YORK—The founder of the China Motors Corp., Dr. S. C. Hu, has acquired from the U. S. government floor space in the former Ranger Aircraft DPC plant in Jamaica, Long Island. He plans to convert surplus property, particularly aircraft engines, for ultimate use in China as prime movers. Later, he intends to make arrangements with U. S. manufacturers for production of their items in China in cooperation with them on a profit-sharing basis. It is reported that these items will be largely light mechanical equipment, such as hand tools, simple machine tools, and eventually automobile and aircraft accessories.

This information was previously published (AM-November 22, 1945, page 148a), but Dr. Wellington Koo's name was used instead of Dr. S. C. Hu.

ASSOCIATION NEWS

L. W. Delhi, of Western Pipe and Steel, South San Francisco, has been named president of the **California Metal Trades Association.** Vice president is **A. E. McIntyre,** general manager of the Nordstrom Valve Co., Oakland, Calif.

A. R. Zapp, carbide products manager of the Firth-Sterling Steel Co., McKeesport, Pa., has been awarded the annual medal of **The Wire Association** for the "most meritorious technical paper of the year written by a member of the association on wire production and fabrication." Mr. Zapp's paper describes the complete history of sintered carbide dies and their multiple applications in this field.

E. J. Schwanhausser, vice president of Worthington Pump & Machinery Corp., was elected president of **Diesel Engine Manufacturer's Association** at their annual meeting, Dec. 11, in Chicago. **Gordon Lefebvre,** president of Cooper-Bessemer Corp., and **J. E. Peterson,** vice president of General Machinery Corp., were elected vice presidents. **Robert H. Morse, Jr.,** vice president and general manager of Fairbanks, Morse & Co. was re-elected as treasurer for the coming year.

Adrian L. Potter has been appointed staff head of the New England division of the **National Patent Council.** Since 1942, Mr. Potter has been executive secretary of the American Society of Tool Engineers.

The **American Foundrymen's Association** has approved the formation of a 32nd chapter, with headqurters in Mexico City, Mexico.

U. S. Patent Office Streamlining to Handle Expected Invention Boom

WASHINGTON — New technologies and materials developed during the war, and the demand for new products, are going to result in unprecedented patent activities. The Patent Office's recently-appointed Commissioner Casper W. Ooms is setting out to revise his services up to this modern-day need.

With energy and diligence not always seen in the government, and with extensive knowledge in his field, Mr. Ooms is rehabilitating his own shop first. He expressed the opinion to a representative of American Machinist that administrative changes will take care of about 90% of needed improvement. For the other 10% he will call upon Congress at the proper time.

Opinion Studied

At present the Commerce Department's patent survey committee is trying to get an over-all opinion of interested persons on patent policy. This committee will issue an interim report very soon, but its final conclusions will not be ready until next summer or autumn. On the basis of the survey, the Department will sponsor such bills as appear to be necessary.

Meanwhile, the Commissioner has formed a four-point basic program to be carried out in his bureau: (1) increase the speed and efficiency of his service by means of more and better-paid personnel; (2) with this improved staff, intensify the search of prior art, against which applications must be tested; (3) by formulation of more positive rules governing examination of patent applications, prevent unpatentable matter from being processed into patents; (4) after an interval sufficient to insure the inventor against piracy, his application can be published to solicit the exposure of any anticipation that may have escaped the Patent Office.

Litigation Aspects

Patent litigation is a difficult subject, and becoming more so. It is not surprising that federal judges, especially those newly appointed, are unable to deal wisely with all manner of subjects, including patent cases. To remedy this situation a single Court of Patent Appeals has often been suggested. The Commissioner says that though he formerly looked with disfavor upon the proposed patent court, he now feels that it has considerable merit.

Most of the patents thrown into litigation are invalidated, yet all leave the Patent Office with a presumption of validity. Any progressive patent policy must find some way, the Commissioner says, of reconciling standards of judgment in litigation with those exercised in granting the patents. Much of the confusion in court is attributed to contradictory expert opinion.

The Commissioner is asking himself: (1) whether the design patent should better take the form of a copyright registration; (2) is the present patent form a clear, concise disclosure, or does it contain too many obscure, literal distinctions; (3) does the Patent Office emphasize form to the disparagement of substance; (4) could industry be protected against invalid patents by timely publication of applications, which would reveal obscurities to examiners before issue of the patent?

Some Compulsory Licensing

There may be some room for compulsory licensing, urged these many years, but the Commissioner believes that it is justifiable only where the public interest is thwarted by the presence of a patent, and where there is no other solution to the public need so denied. Compulsory licensing, in general, would place every invention in the market, and would stultify the incentive to experimentation and development, in his opinion.

Canada Expects Export Benefits From U. S. Loan to Great Britain

OTTAWA—For Canadian exporters and potential exporters in all fields the most significant feature of recently negotiated agreement for an American loan to Britain was the provision for dissolution of the sterling area dollar pool. The threat which a permanent sterling bloc presented to Canadian export business was vividly brought home to the individual manufacturer in recent months when a number of them ran into a stone wall in trying to arrange for export sales to Britain and other countries in the sterling area. From the point of view of making sales, things have not improved much yet.

Friction with British

Meantime, the government is advising business to be patient and trying to minimize irritations which tended to develop between itself and the British. For instance there have been complaints both on the part of business and in parliament that recent British restrictions constitute a violation of the preferential trade agreement between the two countries in that they amount to a discrimination against Canadian exporters in favor of sterling currency countries.

Informal representations to this effect were made to the British government which promptly came back with the charge that the Canadian price ceiling constituted a violation of the spirit of the agreement on the part of Canada. That is an old story. Costs of production in Britain as well as in most other countries have increased to a much greater extent than in Canada because of the operation of Canada's tight controls. In order to assure the importation of essential goods the government has subsidized certain imports so that they can be sold in Canada under the ceiling.

The amount of the Canadian loan to Britain has been variously predicted as from $500,000,000 to $1,500,000,000. Actually it will be what the British want and what is likely to be their probable deficit in Canadian dollars over a given period of years. By the terms of the American deal, Britain is barred from borrowing from a commonwealth country on terms more favorable to the borrower than those of the American loan. This means that Canada will have to give Britain considerably better treatment than is given to France and other allied countries getting reconstruction loans who are charged an interest rate slightly over the Canadian government's borrowing cost which is three per cent for 20-year money.

Canadian Trade Aided

The Canadian loan, the American loan and dissolution of the sterling bloc together promise the possibility of a resumption of triangular payments which enabled Canadian trade to grow before the war. In other words they will permit Canada to convert its sterling surplus into U.S. dollars to meet its deficit of payments to the United States.

Plastics Industry Expanding

NEW YORK—Over $107,000,000 will be spent by 22 companies on new facilities for plastics production, according to a survey of the Plastics Materials Manufacturers Association. In making this announcement, W. S. Landes, president of the association, said this did not include new construction and tooling by molders, extruders and fabricators. This expansion will increase annual output of plastics by about 300,000,000 pounds in about a year-and-a-half. Demand for plastics continues in excess of output, he stated, but may ease during the first quarter.

Names in the News

Clarence A. Fee

Clarence A. Fee has become president and general manager of the Abrasive Co., Philadelphia, a division of Simonds Saw and Steel Co. Mr. Fee succeeded **J. W. McLean,** who retired after 16 years as president and 44 years association with the parent concern. Mr. Fee joined Simonds in 1912 and was appointed Chicago branch manager in 1929.

George Brainard has resigned as president of General Fireproofing Co., Youngstown, Ohio, to become president of Addressograph-Multigraph Corp., Cleveland. Mr. Brainard was former chief of the War Production Board's Tool Division. **J. G. Rogers,** former president of Addressograph-Multigraph has retired from that position to become chairman of the executive committee of that company. **Walter Bender** has become the new president of General Fireproofing Co.

Harold J. Ritter was recently elected president, treasurer and a member of the board of directors of the Norma-Hoffman Bearings Corp. Mr. Ritter was with the company for 28 years until his resignation in 1944, having held various posts including those of sales manager, vice president and director.

Walter F. Nessen has been appointed chief industrial designer for Product Designers, Chicago. He was formerly with General Motors Corp.

R. R. Bauman has been appointed Chicago sales representative of the Ajax Flexible Coupling Co., Inc., Westfield, N. Y. with headquarters at 407 South Dearborn St.

J. T. Parsons has been appointed district manager of the Peninsular Grinding Wheel Company's Pittsburgh branch.

Elmer Rahe has been appointed sales manager of the Globe-Wernicke Co., Cincinnati.

H. A. Malcom, formerly assistant general sales manager, has been appointed general sales manager of the Airtemp Div., Chrysler Corp.

Maurice P. Whitney, formerly chief engineer, has been appointed acting general manager of the Eclipse Machine Div., Bendix Aviation Corp., Elmira, N. Y., to succeed **T. W. Tinkham,** recently resigned. Also, **Frank T. Christian** has been named chief engineer of the division.

William N. Mackay has been named director of sales and advertising for Newman Brothers, Inc. and its subsidiary, Jefferson Machine Tool Co., Cincinnati. He held this same position with the Newman interests for ten years prior to his association with the R. K. LeBlond Machine Tool Co., as time study engineer, during the war years.

Harry B. Newell, formerly executive vice president, has been elected president of the Ohio Forge & Machine Corp., Cleveland, succeeding the late **S. C. Dalbey.**

Edward B. Arenson has been named president of the Toledo Steel Warehouse & Supply Co., recently incorporated, and general manager of the Toledo Iron & Steel Co., a subsidiary.

William H. Moriarty has been elected vice president in charge of sales of National Malleable & Steel Castings Co. At the same time, the retirement of **James A. Slater,** vice president in charge of railway sales, was announced. Mr. Slater has been with National Malleable for the past 48 years.

John M. Newman was recently appointed general engineering supervisor over steel mill, machine tool, brakes and drum controller divisions of Cutler-Hammer, Inc., Milwaukee.

William M. Allen has joined the New Products Engineering Co., Dayton, Ohio. For the past three years he has been doing research and development work in aircraft armament at Wright Field.

A. J. Fisher, Jr. has been appointed supervisor of materials, materials control and production schedules of the Martin-Parry Corp. and its subsidiaries.

Ray L. Morrison, formerly vice president and general manager of the Bendix-Westinghouse Automotive Air Brake Co., will head the new brake division of the Timken-Detroit Axle Co.

R. E. Bloye, formerly assistant manager of the manufacturing division, has been appointed works manager of the new Melrose Park works of the International Harvester Co.

John J. Cronin has been named general manufacturing manager of Fisher Body Div., General Motors Corp., succeeding the late **George C. Paterson.**

Charles E. Kline, formerly with Republic Steel Corp., has been elected vice president in charge of sales of the United Tube Corp. of Ohio.

George L. Green, vice president of the Mt. Vernon Car Mfg. Division, has been appointed vice president of H. K. Porter Co., Inc., Pittsburgh.

Wilburn H. Swanson, for several years superintendent and general purchasing agent, has been appointed general manager of N. A. Strand & Co., Chicago, succeeding **Clyde W. Blakeslee,** who has retired. Mr. Blakeslee has been general sales manager and general manager during the past 25 years.

Charles A. Ulsh

Paul W. Eberhardt

Paul W. Eberhardt has been elected vice president of Walter Kidde & Co., Inc. He will be in charge of the company's domestic sales of fire-fighting equipment in aviation and general industry as well as heading field selling activities.

Charles A. Ulsh has returned to Boeing Aircraft Co., Seattle, as general superintendent of the tooling department, following his recent discharge from the Navy.

Henry E. Guerin, inventor and Douglas Aircraft Co. executive, retired on January 1 after 25 years of service with the company. For the past five years he has been plant manager of the parent Douglas Santa Monica factory. He is also known for his development of the "Guerin process," which forms airplane parts under hydraulic pressure.

Joseph W. Sears, previously district sales engineer at the Link-Belt Co. plant in Dallas, Texas, has been appointed district sales manager with headquarters at 711 Main St., Houston. He has been succeeded by **Stuart Penick.**

C. F. Johnson has joined Watson-Stillman Co., Roselle, N. J., in charge of engineering in the forged steel fitting and the bronze and forged steel valve divisions.

Raymond T. O'Keefe, Jr., vice president of the Kropp Forge Aviation Co., has been elected vice president of the Kropp Forge Co.

Robert Digges, formerly administrative manager at Marin shipyard, Sausalito, Calif., has been appointed general manager of Marinship Corp. to succeed **William Waste.**

B. A. Springer has become a sales engineer for the Baldwin Locomotive Works. He will be in the Chicago office of the Southwark division of Baldwin, specializing in hydraulic presses.

George L. Davis, formerly general staff manager of sales for Carnegie-Illinois Steel Corp., and **Edward Mitchell** have joined the sales staff of the Continental Foundry & Machine Co.

George D. Yeazel has been named factory sales representative in Kansas City, Mo., for the Surface Combustion Corp., Toledo, Ohio. He will have his headquarters at 950 Dinks Building.

BUSINESS ITEMS

International Detrola Corp., Detroit, has sold its machine tool manufacturing interests to **Gisholt Machine Co.,** Madison, Wis. Sale includes transfer of the building of the Fastermatic turret lathes and superfinishing machines, but does not include the transfer of any manufacturing facilities.

Lodge & Shipley Machine Tool Co., Cincinnati, has appointed **The Rudel Machinery Co., Inc.,** 532 Statler Bldg., Boston, Mass., as its exclusive representative in the New England territory.

Republic Industries, Inc., New York City, has acquired controlling interest in the **Geometric Stamping Co.,** Cleveland. **Dave R. Jones** remains as president and general manager of Geometric, which he founded 30 years ago.

Progressive Welder Co., Detroit, has appointed **H. B. Axtell** to represent the firm in the eastern district along with **V. A. Chern.** Eastern offices have been established at 15 Gramercy Park So., New York City.

Carboloy Co., Inc., Detroit, has appointed the **Harris Pump and Supply Co.,** Pittsburgh, as its distributor in western Pa., eastern Ohio, and northern W. Va. **P. Frauenheim** will serve as Harris' full time carbide specialist.

The **Briggs Clarifier Co.** has been acquired by **The Briggs Filtration Co.,** Bethesda, Md. Officers, who served with the old company include **Chase Donaldson,** president, and **S. W. Briggs,** vice president.

W. Haddon Judson Mfg. Co., Philadelphia, has changed its corporate name to **Judson Bros. Co.**

Detrex Corp., Detroit, has established new and larger offices for its Pacific coast region at 112 W. Ninth St., Los Angeles.

Baker Steel and Tube Co. has moved its warehouse and sales office to 1400 Calzona St., Los Angeles.

Ross W. Swogger, former export manager of **The Oster Manufacturing Co.,** Cleveland, is now heading his own export business specializing in machinery and various industrial products.

The **Taft-Peirce Manufacturing Co.,** Woonsocket, R. I., has appointed the **Burleigh-Stocker Machinery Co.,** 1914 Fisher Bldg., Detroit, as its representative throughout eastern Mich.

SM Equipment Co. has moved to new quarters at 5531 So. Vermont Ave., Los Angeles. **J. G. McCoy** has also joined the firm as an associate.

Furnival-Rimmer Co., Philadelphia and Harrisburg, Pa., has changed its name to **Furnival Machinery Co.**

Wabash Appliance Corp., Brooklyn, N. Y., merged on Jan. 1 with the **Wabash Photolamp Corp.** and **Birdseye Electric Corp.** to become a wholly-owned but independently operated subsidiary of **Sylvania Electric Products, Inc.**

The **Cristorch Manufacturing Co.,** recently incorporated, will move from Liberty, Ind., to Cincinnati.

Drayer-Hanson, Los Angeles, has recently acquired a new factory and offices at 3301 Medford St. An additional office will be maintained at 767 East Pico Blvd. for development purposes.

Barwood & Co., 3137 N. 15th St., Philadelphia, has been appointed sales representative for the **Size Control Co.** and the **Walsh Press & Die Co.,** divisions of **American Machine & Gage Co.,** Chicago. Size Control has also established a factory branch at 11 Seneca Pl., Greenwich, Conn., under the management of **Theodore Breunich.**

Davey Compressor Co., Kent, Ohio, has named **J. T. Johnston and Co., Ltd.,** Berkshire, England, as its distributor in the United Kingdom.

Foley & Co., 15 Park Row, New York City, will again represent the **Kropp Forge Co.,** Chicago, in the eastern territory.

OBITUARIES

Alan E. Flowers

Dr. Alan E. Flowers, 69, passed away December 3 at Poughkeepsie, N. Y., after a short illness. Dr. Flowers had, for more than 20 years, headed the research and development department of the De Laval Separator Co., New York City. Before joining De Laval in 1923, he was successively associated with Westinghouse Electric Co. and General Electric Co.

E. W. LaPlant, 73, co-founder of LaPlant-Choate Manufacturing Co., Cedar Rapids, Iowa, died Dec. 4. Although inactive in business since 1927, Mr. LaPlant continued as a director until 1944.

Fred W. Waterman, 76, president from 1928 until his retirement in 1933 of the National Tube Co., Pittsburgh, passed away Nov. 21.

Alexander H. Holcombe, 72, passed away Dec. 4. Mr. Holcombe when he retired two year ago, was Philadelphia representative for the Worthington Pump and Machine Corp.

George E. Smith, 55, vice president of The Midvale Co., Philadelphia, died suddenly Dec. 12.

MEETINGS

American Society for Testing Materials. Spring Meeting. Pittsburgh, Pa. Feb. 25-March 1. C. L. Warwick, secretary, 260 So. Broad St., Philadelphia 2, Pa.

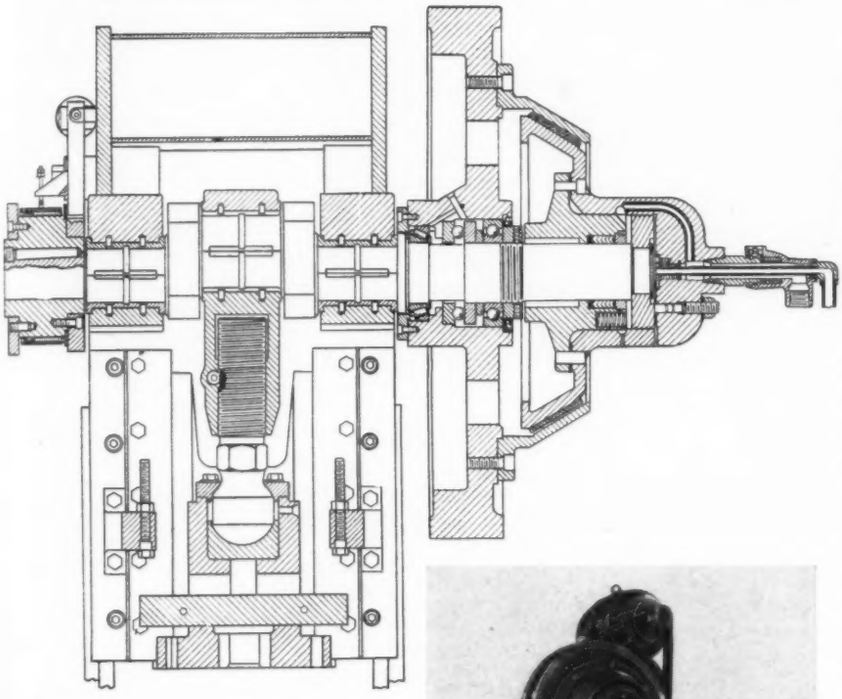
National Metal Congress and National Metal Exposition. Cleveland Public Auditorium. Cleveland, Ohio. Feb. 4-8. W. H. Eisenman, managing director, 7301 Euclid Ave., Cleveland 3, Ohio.

Society of Automotive Engineering. Annual Meeting and Engineering Display. Book-Cadillac Hotel. Detroit, Mich. Jan. 7-11. John A. C. Warner, general manager, 29 W. 39 St., New York, N. Y.

Society of Plastic Engineers. Plastics Exhibit. Convention Hall. Detroit, Mich. Jan. 7-11. Annual Meeting. Horace H. Rackham Educational Memorial. Jan. 7-9. Fred Conley, Chairman Publicity Committee, 510 Stephenson Bldg., Detroit 2, Mich.

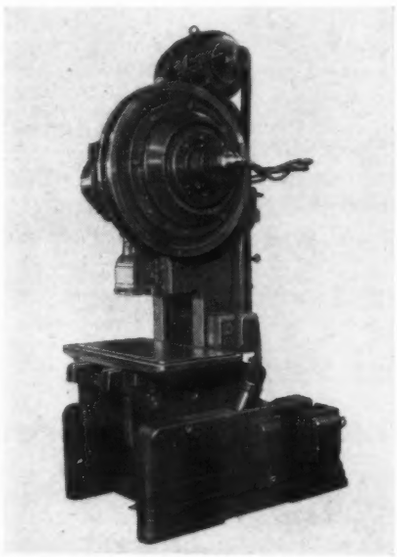
Shop Equipment News

Hydraulic Control, Positive Stop, Characterize Reliance 45-Ton Press



Reliance Hydraulic Press, Inc., 405 Lexington Ave., New York, 17, N. Y., is the producer of a 45-ton press with all controls hydraulically operated. The hydraulic system is installed as an integral part of the press frame and is operated by a 1-hp. motor-driven geared pump. Controls are actuated by a spring-loaded 4-way valve which operates the clutch, brake and positive-stop hydraulic cylinders. The positive-stop cylinder prevents repeating and can be disengaged for continuous operation.

To operate the press for single-stroke, the operator depresses the pedal; this releases the positive stop and engages the clutch. In making a complete cycle, the clutch is released, brake applied and positive stop engaged. This cycle is completed whether or not the operator has his foot on the pedal. To repeat the cycle, the pedal must be released and depressed again. The clutch, brake and positive stop are hydraulically synchronized to disengage the clutch whenever the brake and positive stop are engaged.



The clutch is cone-type with cast-iron face on one side of the cone operating against molded-asbestos clutch material. The clutch is operated by hydraulic cylinder on a work-cycle engagement of 7000 lb., which holds it in. To declutch, 4600 lb. are required. This clutch is at a 30° angle, therefore cannot grab. The maximum working pressure of the cylinder on the clutch is 250 psi. When hydraulic pressure is off, the clutch is declutched by springs only. The inner clutch is mounted by double keys

The clutch is a 30° cone type with a cast-iron face operating against molded asbestos, the brake a one-piece band type lined with standard truck lining.

The positive stop is mounted on the brake unit and is actuated by a synchronized hydraulic cylinder. The safety stop automatically stops the press at top-center regardless of any failure in the braking unit. With the positive stop disconnected, automatic feeds can be installed and the press run at maximum stroke speed of 160 per minute.

Full capacity of 45 tons at the bottom of the stroke will cut a steel blank 1/16 in. thickness and 12-in. diameter with the dies figured in full shear. Crankshaft at the main bearing is 3½ in.; at the crankpin 4¼ in. Standard slide stroke is 3 in.; maximum is 6 in. Standard stroke adjustment is 2½ in.

The punch-shank hole is 2 in. in diameter and 2½ in. deep.

Frame back opening is 15½ in.; between gibs 9½ in. Throat opening, distance back from slide center is 10 in. The frame can be inclined 30°.

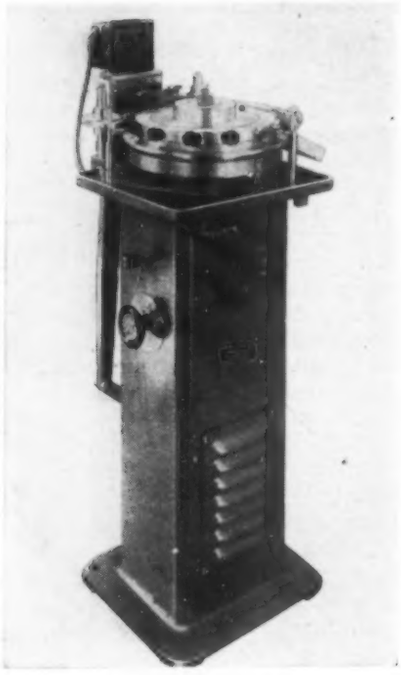
The bed has an area of 19 in. by 27½ in., with a rectangular opening of 12 in. by 16 in. Diameter of the circular opening is 14¼ in. Distance from the floor to the top of the bed is 33 in. with the press erect.

The die-space distance from the top of the bed to the bottom of the slide, with the stroke down and the adjustment up with the standard stroke, is 11¼ in. Distance from bed to gibs at standard is 14¼ in. Bolster plate thickness is 2½ in.

The flywheel has a 35-in. diameter and a 5-in. face. Its weight is 1050 lb. and speed is 160 rpm. when operating continuously. The plain press requires an area 57 in. by 52⅞ in., with a minimum clear height of 101 in.

Electrical wiring consists of permanent wiring from the starting box to the press drive motor and from starting box to the pump motor. A start and stop button, which may be cut out when the press is operating from a roll feed, is provided for each motor. Motors are standard ball-bearing types wound to suit current characteristics at the installation.

Noblewest Dial-Feed Marker Operates As Production Unit



When marking on plastics it is sometimes desirable to use a roll leaf to apply color to the marked inscription in the same operation, and an automatic roll-leaf attachment is provided, this having ratchet feed. The marking die is heated by means of an electric heating unit, and a rheostat is provided to give uniform control to the heat. For marking on metal parts, a marking die cut sharp face is used and additional pressure is applied to give a deeper impression

A marking machine with dial feed, Noblewest Model G232, is built by Noble & Westbrook manufacturing Co., Westbrook St., East Hartford 8, Conn. This machine is used for production marking on the flat surfaces of small parts, the inscription consisting of one or more lines of characters.

The machine can be arranged for marking on steel or other metal parts as well as molded plastic parts. Marking pressure is adjustable and is arranged with compensating spring to allow for variation in wall thickness or surface. Work parts are fed into stations or nests on the carrier dial, each station being provided with a mandrel support. The dial revolves continuously and carries the parts to the marking die, where they are marked and automatically ejected.

The dial has vertical adjustment for positioning up and down as well as a lateral movement for sideways adjustment so the inscription can be placed on the work in the desired location. The shaft on which the dial is mounted is driven by a worm-gear unit which runs in a bath of oil.

A V-belt drive to the motor, which is mounted in the base of the column on an adjustable bracket, provides for speed variation.

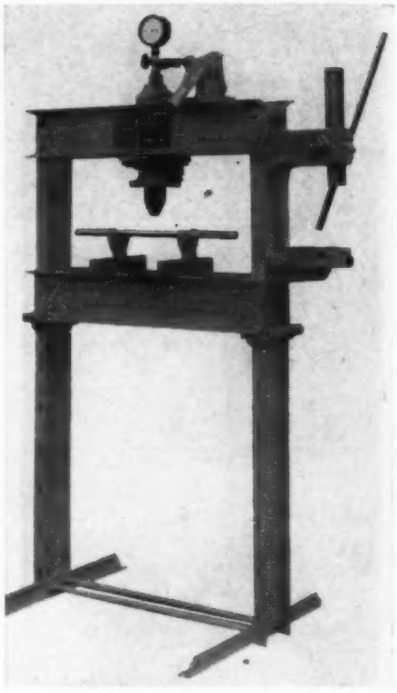
Work can be marked as fast as 25 to 50 parts per minute, depending upon the shape and size of the part.

Sav-Way Plastic Heat Sealer Closes Thin Film Inclosures

A process for joining plastics or foil for heat-seal packaging is announced by Sav-Way Industries, Detroit, Mich. The machine is designed to handle both plastic film and foil and Grade C sealable paper, wax impregnated or wax coated.

An electronic temperature control holds heater bars within one degree up to 500 F. Steel belts carry the material to be welded between the heater bars, from 10 to 38 ft. per min. at controlled pressure, and through a cooling zone in one operation. Pressure between heater bars is adjustable and held by spring tension to precise limits, and the bars are mounted to be self-aligning. Wiper-type oilers of heavy felt are provided to wipe the metal belts and prevent them from sticking.

The design of the heater bar face, which concentrates heat in the center of the weld, distributes heat gradually to the outer edges. The cooling zone, like other steps in the process, is controlled to cool the film gradually after welding to prevent distortion. The machine is designed for use in conjunction with a moving belt which can be synchronized to the speed of the metal belts, and will carry units to be sealed at a uniform speed.



Standard equipment of the Mech-Art press includes—2 steel parallel bars, 2 malleable V-bolts, 1 malleable ram nose and 1 pump handle. Pressure gage and 2-ton rack and pinion arbor press, which also may be bench-mounted, are accessories. Table travel is 35 in., ram travel 4½ in. and width between table channels 5⅛ in. Overall height is 60 in. and floor space 34x27½ in

Mech-Art Hydraulic Ram Press Is Hand-Operated and Portable

Pressing, straightening, bending, flattening, assembling and other operations can be performed on the 25-ton hydraulic press manufactured by the Mech-Art Products Corp., York, Pa. The press is self-contained, and can be moved about at will. Power is applied by hand operation and eight strokes of the pump equal 1 in. of ram travel.

The press cylinder is a steel casting. The table is supported by two alloy steel pins which rest in four inverted V-bearings. Handle grips at end of table make possible adjustment in the height of table to handle various size work. Distance between uprights is 30 in., to handle long shafts. The table travel is 35 in., ram travel is 4½ in., ram diameter is 2¾ in., width between table channels is 5⅛ in. Over-all height is 60 in. and floor space required 34 x 27½ in. Weight is 420 lb., with arbor press.

IN DOUBT ABOUT YOUR LATHE EQUIPMENT?

● Maybe you've been thinking that your lathes are not putting out enough to keep higher labor and material costs in line. If they can't reduce your costs it's a sound conclusion to consider these lathes OBSOLETE!

Lodge and Shipley has designed engine and automatic lathes that will offset higher costs. The L & S 18, 20 and 22 inch engine lathes are revolutionary in design—entirely new and different in every part. Or consider the new 2A and 3A Duomatics. Unskilled operators handle these automatics easily. The worker merely loads and unloads the work and starts the operation cycle. The machine does the rest.

One of these lathes may actually equal several of your older models in total output. L & S Engineers will demonstrate on your work how these lathes cut costs. Write on your company letterhead for Bulletins Nos. 500, 503, 605, (engine lathes) or Nos. 601 and 620 (for Duomatics).

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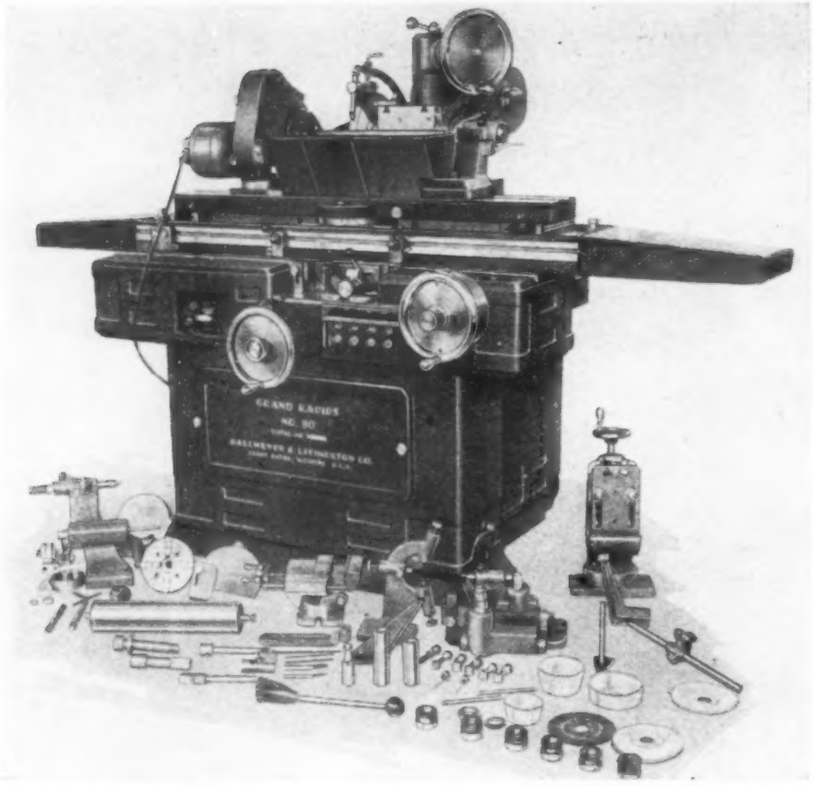


Speeds range from 4 in. to 50 ft. per min. for this universal tool grinder

Grand Rapids Hydraulic Grinder Provides for Universal Setup

The Gallmeyer & Livingston Co., Straight Ave., S.W., Grand Rapids 4, Mich., has developed a Grand Rapids hydraulic-feed universal and tool grinder which is being built in two sizes, No. 70 and No. 80. The two grinders are identical except that the table of the No. 80 machine is 6x50 in. and has a longitudinal movement of 32 in. while the No. 70 machine is equipped with a 6x42 in. table having a longitudinal movement of 24 in. The tables have an unlimited number of hydraulically operated speeds ranging from 4 in. to 50 ft. per min.

Ball bearings carried in Micarta retainers on carbon-steel ways with hardened and ground tool-steel inserts insure easy movement of the tables by means of handwheels, which can be used on jobs for which the hydraulic table feed is not adapted. Both the No. 70 and the No. 80 grinders are obtainable with a motor-driven dust-collecting system when this is desired in preference to the coolant system, or machines may have both.

These grinders have a swing diameter of 12 in. The No. 70 machine has a swing length between the right- and left-hand tailstocks of 30 in., while the No. 80 machine has a swing length of 38 in. Cross-movement of the wheel is 10½ in., and vertical movement of the spindle is 9¼ in. Maximum distance from center line of spindle to top of table is 12¼ in.

The table swings 90° in either direction. Graduations on the end of the table provide for taper settings up to 3 in. per ft. The swivel plate is graduated to 180° and the spindle swivel movement is graduated to 360°. Table traverse per revolution of the handwheel is ½ and 3 in. Spindle speeds range from 2850 to 5800 rpm. and work speeds from 80 to 525 rpm. Internal-spindle speeds from 9100 to 18,500 rpm. are available. The vertical and cross feeds have 0.001-in. graduations, while the fine cross feed has 0.0001-in. graduations.

Five motors ranging from ¼ to ¾ hp. are used to drive the spindle, hydraulic pump, workhead, coolant pump, and dust collector. The No. 70 machine requires a floor space of 100½x57 in. and weighs 3500 lb. with standard equipment, while the No. 80 machine requires a floor space of 124½x57 in. and weighs 3700 lb.

Logan R-F-L Air-Line Unit Meters Pneumatic Lubricants

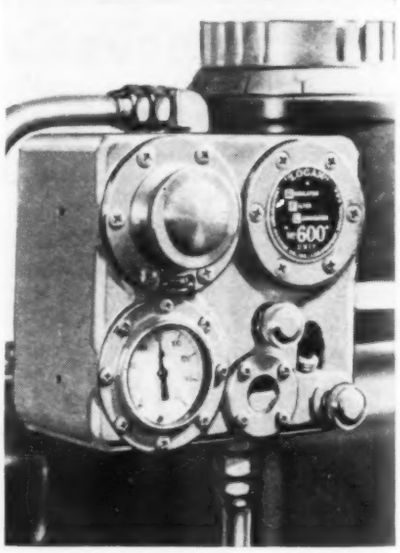
The R-F-L unit is a development of the Logansport Machine Co., Inc., Logansport, Ind., for use with air-operated equipment.

In a casting measuring 6 in. square by 4¾ in. deep, the R-F-L unit incorporates all components of an assembly of reducing valve, pressure gage, filter and lubricator. All connections are built into the casting. All components are controlled from or visible on the front panel. The unit is mounted in the air intake from the main air line, and is adapted to location on a central control panel. The unit levels out surges and sudden drops in the air supply and keeps working pressure uniform.

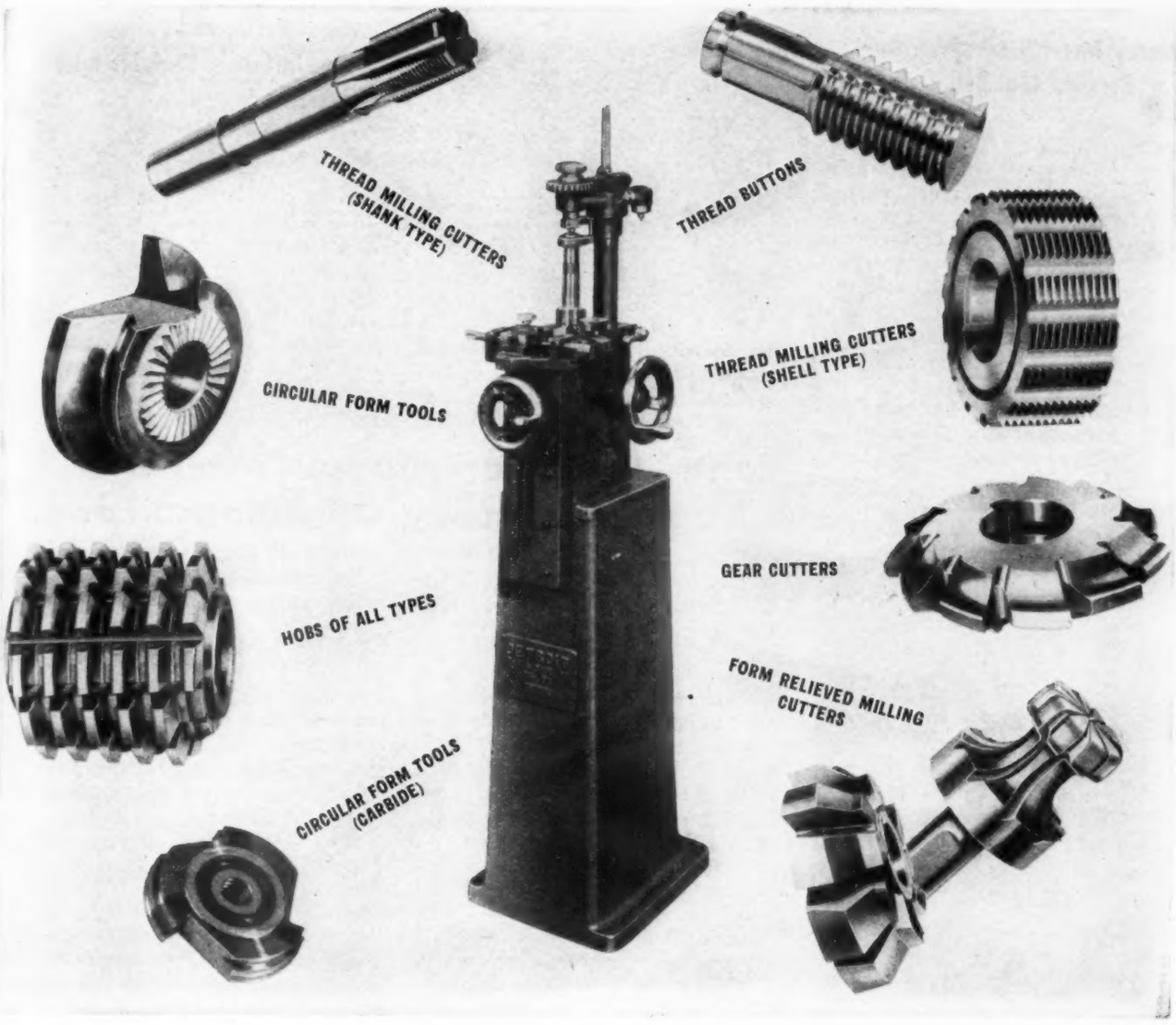
Two knobs adjust the air pressure and amount of oil injected. The third knob drains the water trap when necessary. Complete visibility of the air pressure gage and oil supply level is provided on the front panel. The recessed plug is removed for refilling of the oil reservoir. Inlet and outlet ports, drain ports and mounting holes are provided in alternate locations.

Control of bellows-type reducing valve has long travel, permitting accurate adjustment to the required air pressure. An accurate air-pressure gage is also provided.

A replaceable porous-metal filter traps moisture and foreign matter, supplying clean dry air to the air system. The filter is easily removed for cleaning. Moisture drips from the filter into a water reservoir.



Logan R-F-L unit automatically meters required amount of oil into air supply. By means of a knob on the front panel, the metering needle is adjusted for varying work requirements



You can check all these tools

ON A DETROIT HOOK CHECKER

Time consuming and cumbersome positioning of cutters and adjusting of equipment are eliminated on this "Detroit" Universal checker for all types of relieved form cutters. The result is faster and more accurate checking of hook or rake angle and of spacing of gashes or flutes after sharpening.

To check hook or rake all you do is slip the cutter between centers, bring the knife edge against the sharpened face by turning a micrometer until you can't see light between the two. Read the "Mike". The integral flute indexing head makes spacing checking just as simple.

For complete specifications and description of this remarkably simple and effective checker, ask for Bulletin HC-43.

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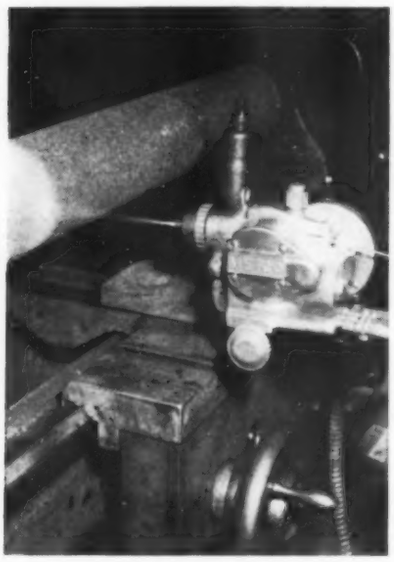
SPECIAL THREADING TOOLS, MACHINES & CHECKERS
•

Metco Metallizing Spray Gun Permits Continuous Operation

The Metco type Y metallizing gun manufactured by Metallizing Engineering Co., 38-14 30th St., Long Island City 1, N.Y., is designed for mechanical mounting and continuous operation. It uses 3/16-in. wire which, when combined with an acetylene pressure of 15 psi. more than doubles previous spraying speeds.

The type Y gun—because it is designed without regard for weight and size limitations necessary for the hand gun—is heavier and more rugged in construction. Gears, worms and bearings are several times larger than those used previously and reduce wear and replacement.

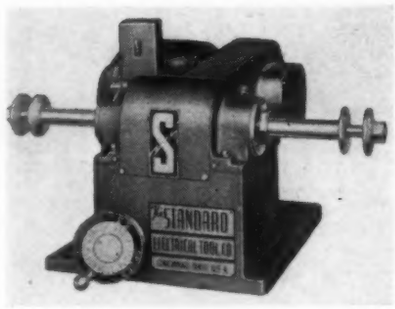


Fluid lubrication and a built-in forced feed pump assure an adequate supply of lubricant to all bearings regardless of operating position. The gun is non-sensitive to gas and oxygen pressure variations, as great as 10 lb., either while lighting or while spraying

Electro Precision Motors Accurately Maintain Speed

An a.c.-d.c. electric motor, model DS-105, weighing 11 oz. and developing 1 oz-in. torque at 8000 rpm. and 4 oz.-in. locked torque, is a product of Electro Engineering Industries, 800 N. Clark St., Chicago, Ill. Body dimensions are 1.687 in. dia. by 2 9/16 in. long, with ¼-in. dia. shaft.

Motors are wound for 6 to 115 volts, and have sealed ball bearings, diecast housings, ground cores, and laminated fields.



The Standard polishing machine is mounted on a bench base and is equipped with flanged spindles, but can be furnished with taper spindles

Standard Buffer and Polisher Has Infinitely Variable Speeds

The Standard Electrical Tool Co., 2480 W. 6th St., Cincinnati 4, Ohio, announce the type 1BVB infinitely variable-speed buffing and polishing machine. The 1BVB is powered by a 1-hp. motor. Through the special control located at front of machine it is possible to obtain any spindle speed between 1500 and 3000 rpm.

This unit will serve in the production of small parts for either buffing or polishing at the correct spindle speed and, as wheels wear, the spindle speed may be increased.

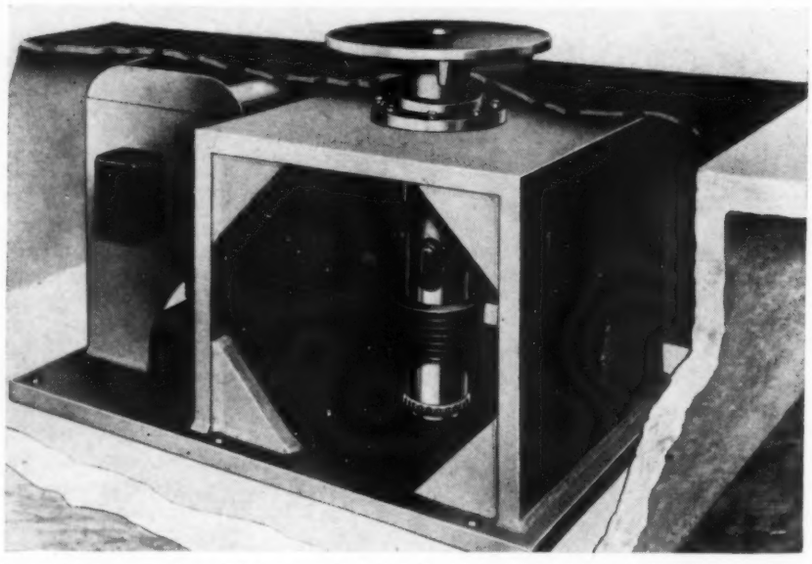
Centri-Meco Centrifugal Caster Swings Heavy Off-Balance Loads

The Centrifugal Machine & Engineering Co., 637 Jackson Court, Kalamazoo 7, Michigan, announces a Master model centrifugal casting machine. It is built for heavier off-balance loads, for continuous production and free-spinning power. Its construction—net weight 3,700 lb.—is so designed that the standard 24-in. spinning head may be extended up to 60 in. dia. by the installation of an adapter plate. Molds may be attached to any workable height.

The hub of the Master model centrifugal-casting machine is turned of 7-in. mechanical tubing of ¾-in. wall thickness. It is heat-free and provides for continuous production operation with permanent molds attached directly to the heavy table mounting-plate. The table has four strut-vanes which act as a fan to carry away the excess heat that is radiated above the top bearing. This type of hub and table construction holds the temperature in the bearing area to 125 F.

Protective hoods and spill pans are constructed of 10-gage sheet steel according to individual specifications and their telescoping feature makes possible adjustment to any height from 8 in. upward.

The Master model has a motor mounting which is adjustable to standard belt lengths to permit greater variation of speeds by mechanical changes of drive pulley. Motor of standard model is in ratio of 1 to 1 but by changing the drive sheave any desired speed may be obtained from 400 rpm. to motor speed.



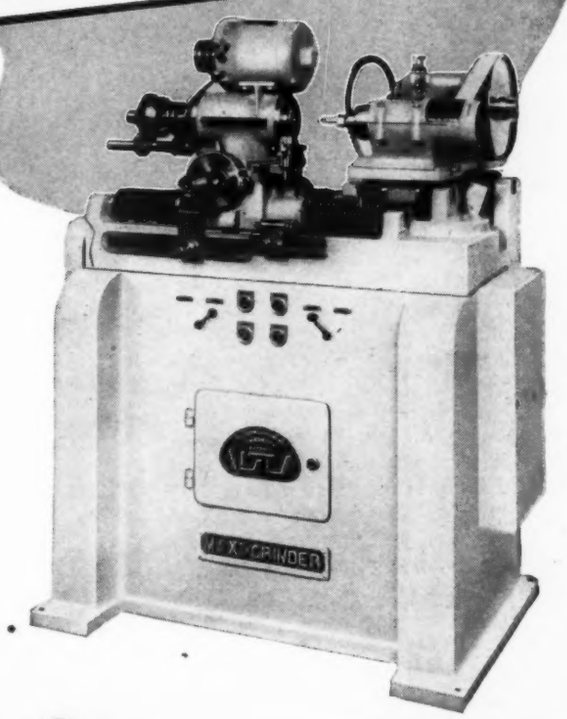
Several types of variable-speed controls, from 218 to 1750 rpm., make it possible to deliver torque continuously. It may also be operated intermittently from 0 to 218 rpm. Dynamic braking and mechanical braking obtainable. Electronic drives may be installed on custom-built Centri-Meco casting machines where greater ranges of higher or lower speeds than these are needed

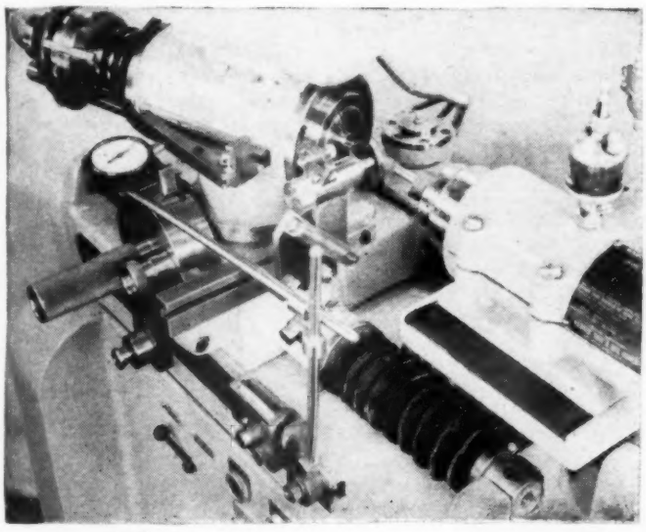
Here is An Innovation In INTERNAL GRINDER DESIGN *that offers*

WIDER RANGE
SIMPLICITY OF OPERATION
SPEED and PRECISION

Choose the Maxi-GRINDER for ultra-finish and extreme accuracy on *any* internal grinding operation. The features listed below qualify this unit for your toughest jobs.

- Convenient grouping of controls leaves operators right hand free for loading and unloading work head.
- Entirely automatic collet opening and closing.
- Mechanical differential unit drives grinding-spindle carrier —eliminates bell-mouth holes.
- Easily adjusted stroke length adapts unit to shoulder and blind hole grinding.
- Six spindle speeds, can be slowed quickly for wheel dressing.
- Micrometer feed on diamond wheel dresser quickly adjusted.
- Totally enclosed feeding mechanism is free of backlash, protected from dust.
- Built in sine bar simplifies taper and angular hole grinding.
- Separate motors provided for each operation. Push buttons control all functions.





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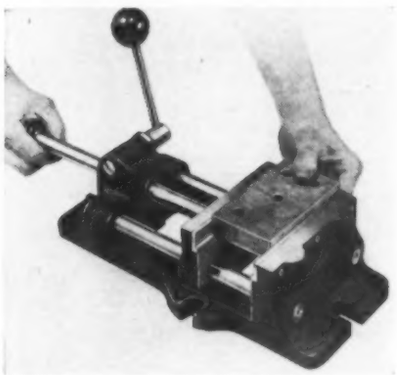
Heinrich Grip-Master Locks With Positive Cam Action

Instead of an adjusting screw, the Heinrich Grip-Master has a movable jaw which can be adjusted to the work and locked securely by a locking lever. Bars and locking mechanism are hardened and ground. Wide clearance between the jaw guides permits drilling right through the work and prevents interference from accumulating chips. Jaws have built-in, recessed parallels. A removable V-jaw accessory is provided for round pieces. The Grip-Master is available with four jaw-widths, 3, 4, 6, and 8 in.



Jaw opening of the Heinrich Grip-Master is set by a sliding lever and locked by pressing a cam lever

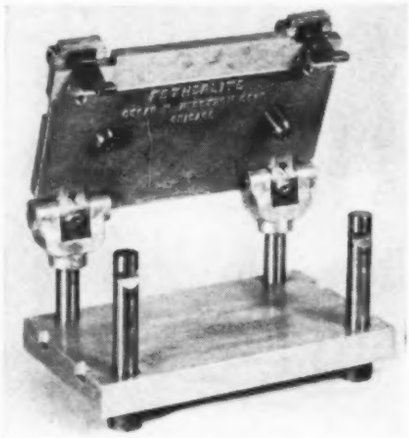
Lightweight Aluminum Body Used For Hedstrom Fetherlite Jigs

Standardized Fetherlite jigs manufactured by the Oscar W. Hedstrom Corp., 4836 W. Division, Chicago, Ill., are made of OH-38, a non-heat-treated aluminum alloy. Two types of jigs are featured, the Quick-Latch type and the Snap-lock type.

The Quick-Latch jig is made in two sizes, one with 4½x5x1-in. opening and the other with 4½x5x2-in. opening and has a tumble-spring controlled latch which automatically holds in the unlocked position when open and in the locked position after closing. This jig is also provided with adjustable-tension, spring-plunger clamping screws which can be placed to hold the work.

The Snap-Lock jig is made in a range of sizes from 4x6-in. base to 10x24-in. base and may be assembled for 1-, 2-, 3- or 4-way drilling and with vertical openings to suit work.

The parts are interchangeable and may be assembled into units of various types and sizes from stock parts. Castings of these parts are also made of OH-38 aluminum alloy which can be easily machined.



All-Position Electrode Welds Dissimilar Metals

A phosphor-bronze electrode for use in all-position welding of brass, bronze, copper, cast iron and steel has been developed by the Alley Rods Co., York, Pa. Cupro-Arc C is designed for operation with d.c. and reverse polarity. It conforms to AWS-ASTM specification E. Cu-2A and Navy specification 46-E-5 requirements for Grade II electrodes. Welding of dissimilar metals, such as brass to bronze, cast iron to steel, bronze to steel and bronze to cast iron, is possible.

Cupro-Arc C has a smooth-flowing arc. Spatter loss is minimized and the deposit is sound and homogeneous, with no porosity. Slag removal is easy.

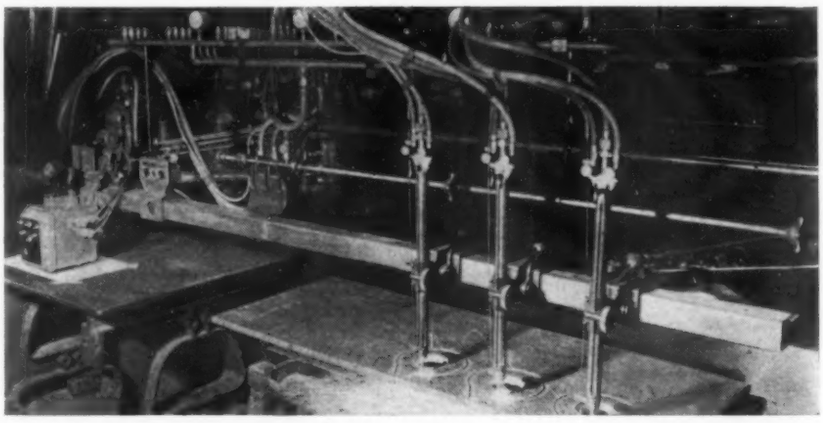
Thin-Coat Porcelain Enamel Reduces Finish Chipping

The O. Hommel Co., Pittsburgh, Pa., announces the development of a porcelain enamel, Tite-Wite. Tite-Wite is an opaque white cover-coat in both regular and acid-resisting porcelain enamels. It can be applied nearly as thin as organic paint finishes. Tests show reflectance readings of 75 to 80% and over, when applications of 15 to 20 grams per sq. ft. are applied. Tite-Wite will permit more extensive use of porcelain enamel as the thin application reduces chipping.

Photoelectric Tracing Head Controls Cutting Torch

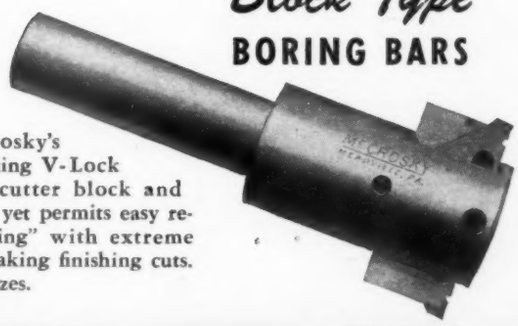
A photoelectric tracing device for pantograph oxacetylene cutting machines is announced by Air Reduction, 60 E. 42 St., New York 17, N. Y. The electronically controlled tracing equipment cuts shapes from outline drawings of the desired piece. Sharp corners may be cut without subsequent machining or the use of jigs.

Templets required for electronically controlled cutting are outline drawings with a black outline ⅛ in. wide against a white background, or any other color combination which provides light contrast.



The electronic tracer control consists of two units—tracing head and control box. All working parts are protected. This equipment can be attached to any Oxygraph or Travograph cutting machine

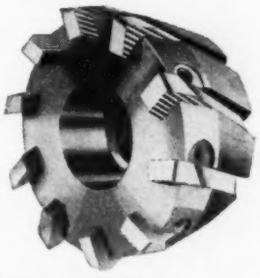
Block Type BORING BARS



Featuring McCrosky's patented centralizing V-Lock that centers the cutter block and holds it rigidly,—yet permits easy release, and "floating" with extreme accuracy when making finishing cuts. Wide range of sizes.

*Jack-Lock** MILLING CUTTERS

Face, shell end, staggered tooth and half-side cutters, featuring McCrosky's exclusive, Jack-Lock wedge that holds the blades rigidly yet permits easy, uniform adjustment for regrinding. Sizes 4" to 20" in diameter. High speed, cast alloy and carbide tipped blades.



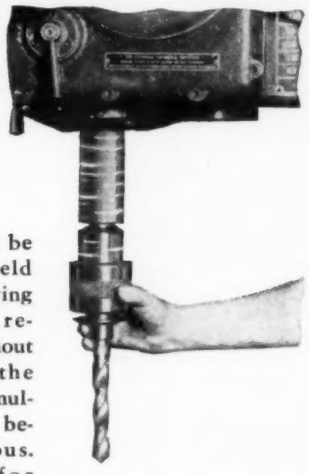
* Trade Mark Reg. U. S. Pat. Office

McCROSKY

COST CUTTING TOOLS

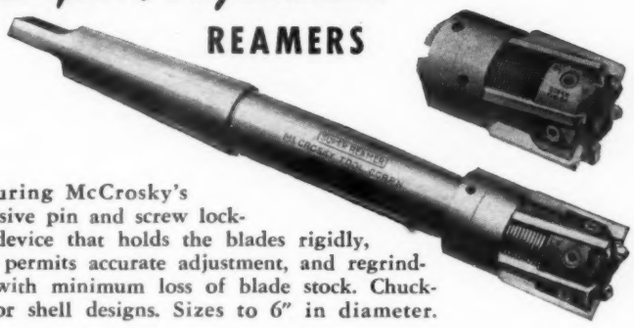
Standard of Quality for 40 Years

Wizard CHUCKS *and* COLLETS



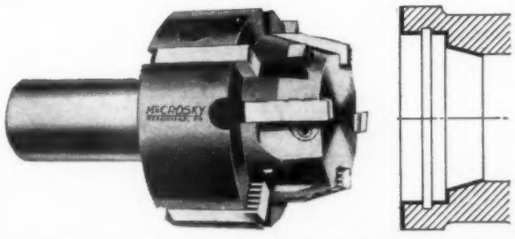
Permit tools to be inserted and held rigidly in revolving spindles,—and released again without slowing down the machine. Thus multiple tool jobs become continuous. Ideally used for high speed tapping to prevent tap breakage.

Super Adjustable REAMERS



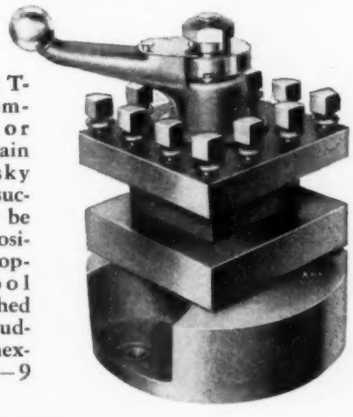
Featuring McCrosky's exclusive pin and screw locking device that holds the blades rigidly,—yet permits accurate adjustment, and regrinding with minimum loss of blade stock. Chucking or shell designs. Sizes to 6" in diameter.

Special MULTIPLE DUTY TOOLS



Individually engineered to each particular job, these "Specials" combine related facing, boring, counter-boring and reaming operations—do them all simultaneously with just one tool—speeding up production and cutting costs. Ideal for long or short runs.

Turret TOOL POSTS



Mounted in the T-slot of the compound rest, or bolted on the main slide, McCrosky Turrets permit successive tools to be indexed into position without stopping for tool changes. Furnished in 5 styles including square and hexagon designs—9 different sizes.

McCROSKY TOOL CORPORATION

MEADVILLE, PA.

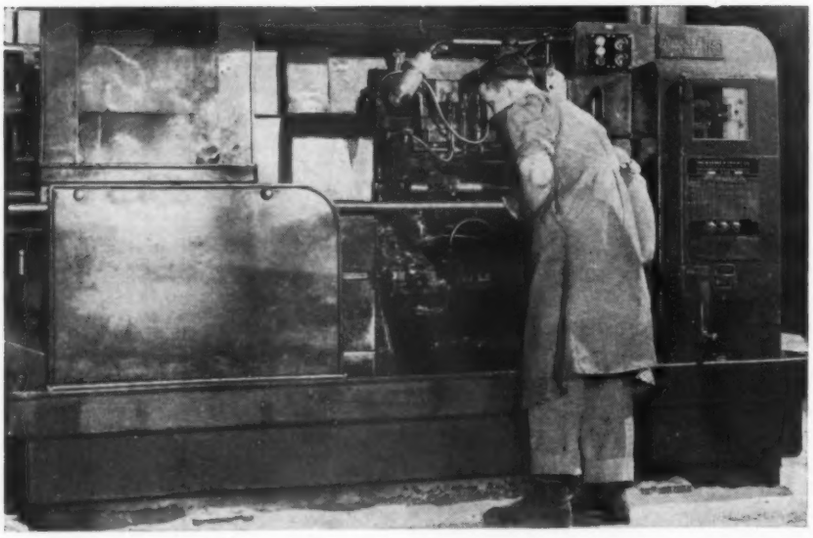
COST CUTTING TOOLS

Designers and Manufacturers of

Jack-Lock MILLING CUTTERS — *Block Type* BORING BARS

Wizard CHUCKS AND COLLETS

Super Adjustable REAMERS — *Turret* TOOL POSTS



An integral set of adjustable quadrant sectors handle normal cam functions in this 5-spindle automatic. Feed stroke is mechanically controlled by a quadrant-linkage combination and simple sliding adjustments set any working stroke without affecting the fast-approach stroke. This arrangement eliminates cams and materially lowers setup costs

Quadrant Linkage Eliminates Cams On 5-Spindle Bar Automatics

The Warner & Swasey Co., Cleveland, Ohio, has developed a series of 5-spindle bar automatics in which the normal cam functions are performed by an integral set of adjustable quadrant sectors. The length of feed stroke is mechanically controlled by a quadrant-linkage combination which eliminates the necessity for interchangeable cams. Simple sliding adjustments set all working strokes from 0 to maximum while retaining the full fast-approach stroke. Cross-slide strokes are also controlled by adjustable linkages.

This feature facilitates production in small lots because of fast setups with no investment in cams.

Twenty-four spindle speeds in usable increments are provided by eight sets of pickoff gears and a high-low shift. Pickoff gears are enclosed in an accessible housing in the end of the machine. They are small and easy for the operator to handle. A lever inside the housing sets the fast or slow range of speeds, as desired.

Cross-slides with separate micrometer adjustments and a disconnecting arrangement are provided in the machine. Use of the disconnecting arrangements permit full toolslide action without indexing the spindle. Four independent cross-slides, a separate cutoff slide, a longitudinal center slide and two independent longitudinal slides make available a combination of accessible tooling stations providing flexibility of tooling arrangements. Tools are interchangeable in all tool positions. Drilling may be done at all five stations; tapping, threading and reaming are available at three stations.

Simple harmonic motion assures rapid shockless bar-stock feeding, which reduces idle time. Amount of stock fed is varied from zero to maximum by a screw adjustment, allowing shockfree contact with the stock stop. Collet-chuck tension may be checked manually, avoiding the danger of excessive strain.

An 18-speed transmission controls the rate of feed of all tools. The gearbox is of the quick-change type, eliminating the necessity of separate loose change gears.

The large chip-collecting area beneath the working stations and the absence of working mechanisms in this area facilitates chip disposal. A chip conveyor is also provided which mechanically feeds the scrap into a container at the foot end of the machine.

SPECIFICATIONS
Models M-2500 and M-2530

		1¾ in.-5	2¼ in.-5
Spindle Capacity, maximum	Round Bar	1¾	2¼
	Hexagon Bar	1½	1 15/16
	Square Bar	1¼	1 5/16
Turning Stroke, infinitely variable between		0-5 in.	
Maximum Length Turned, multiple cuts (longitudinal)		7¼ to 10 in.	
Idle Approach Stroke (longitudunal)		3½ in. std. (2½ or 5 in. spec.)	
Bar Feed Stroke, infinitely variable between		0-10 in.	
Cross Slide Stroke, infinitely variable between		0-⅞ in.	
Independent Reaming Stroke, infinitely variable between		1/32-4½ in.	
Speed range (in 24 steps)		130-1414 rpm.	
Motor	Horsepower	10 or 15	
	rpm	1800	
Drive Shaft	rpm	720	

PRF Corrosion-Proof Cement Hardens Bricked Tank Lining

A corrosion-proof cement known as Pennsalt PRF cement has been developed by the Pennsylvania Salt Manufacturing Co., Widener Bldg., Philadelphia, Pa. This cement is a quick-setting, cold-hardening, acid, alkali and solvent proof product composed of a liquid and a powder which react chemically to form a cement. It has been designed specifically for bonding corrosion-proof brick and tile in uses where both acid and alkalis are encountered.

...SEE REVERE AT THE METAL SHOW CLEVELAND, FEBRUARY 4-8

AT the FIRST RECONVERSION SHOW be sure to see the Revere Exhibit. You will find it in Space B-306, the same location in which you found us in the two previous Metal Shows.

Now we are able to point out, openly, definitely and in much more detail than ever before, the amazing advances in metallurgy born of war. In addition we shall re-emphasize the virtues of the more familiar Revere mill products.

Look for exhibits of Revere magnesium and aluminum, of the new specially-prepared switch copper, the new Free-Cutting Copper, the Certified Oxygen-Free High Conductivity Copper, the amazing special finishes available for Radar, and other products of copper, brass and bronze offering great peace-time potentialities.

Revere Technical Advisors and representatives will be available to assist you.

Revere Exhibit at the 1944 Metal Show

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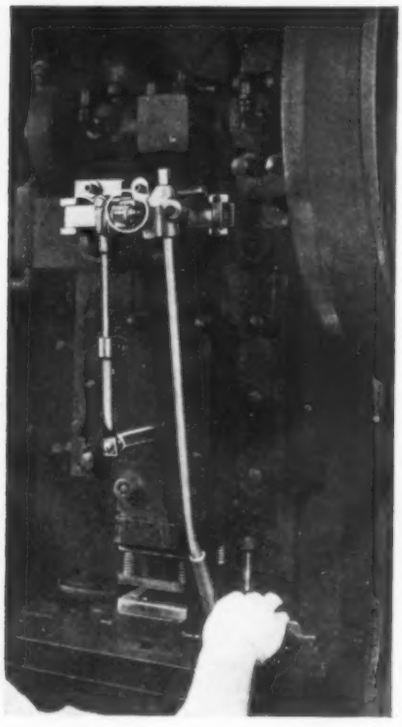
Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p.m., EST

Non-Corrosive G-Sol Solvent Has Low Flash and Fine Points

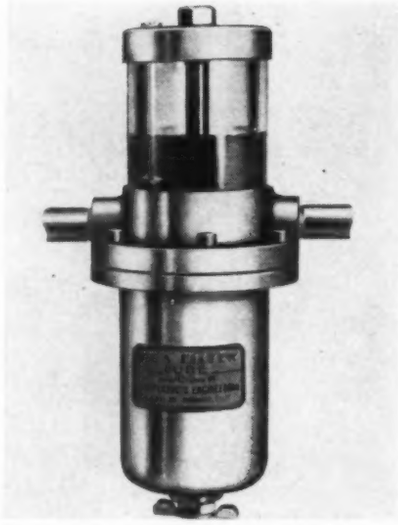
The first of a series of safety solvents to be called G-Sol is announced by the Gaybex Corp., Nutley, N. J. Various grades will be identified by number corresponding to their flash points. G-Sols are water-white and are characterized by high flash points and freedom from elements of toxicity and corrosion. G-Sol 195 has a flash point of 195° minimum (Cleveland Open Cup ASTM). The fire point is 200° minimum. Specific gravity is 0.801 to 0.803 at 20° C. Viscosity is 35 sec. (Saybolt Universal at 100° F.) Distillation residue is less than 0.1%.

Low Spatter-Loss Electrode Developed for Fleetweld Line

The Lincoln Electric Co., Cleveland, Ohio, has developed a shielded-arc electrode with a low spatter-loss that is free from undercut. Deposition speed is high and low-alloy high-tensile steels can be welded as easily, with Fleetweld 11-HT, as mild steel can be welded with the E-6020 type of electrode. Specimens of the weld deposit are characterized by tensile strengths of 75,000 to 80,000 psi. as welded and 72,000 to 76,000 psi. when stress-relieved.



Feature of the Searjeant Counting Guard is the automatic counter which registers each stamping. The counter is placed in full view of operator



The lower element of CCA Filter-Lube is composed of a sludge basin and an all wool felt filter. The device filters incoming air and provides a finely adjusted lube-mist. No flood of oil is permitted to enter working equipment, and no oil starvation is possible

CCA Filter-Lube Unit Protects Air-Operated Equipment

CCA Filter-Lube, a pneumatic filtering unit combined with a precision lubricator, is announced by CCA Products Engineering, Box 671, Glendale, Calif. Designed to prevent freezing of air-operated devices and deter corrosion, CCA Filter-Lube is available in ¼, ⅜ and ½ in. standard pipe line sizes.

A needle valve oil regulator adjustable to meet varying lubrication requirements permits the correct amount of oil to mix with filtered operating air.

Searjeant Counting-Guard Gives Operator Protection

W. H. Searjeant Co., 89 Allen St., Rochester, N. Y., announces a Counting Guard for power presses. Its operating principle is based on the sweep action of an adjustable guard arm which works with the downward motion of the ram. If the link breaks, the guard still operates. While the press is not in operation, the guard remains at the extreme left-hand arc position. As soon as the ram starts the down stroke, the clutch is tripped, the guard sweeps completely beyond the press feed area on half of the downward stroke. Thus, operators' hands are brushed aside before the dies close.

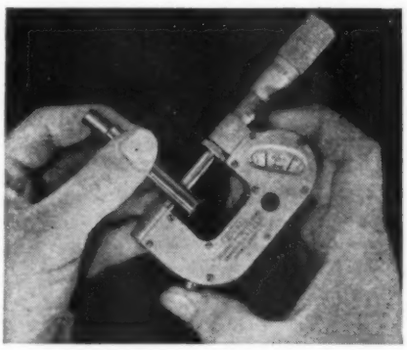
Indicator and Micrometer Combined in Federal Unit

A micrometer with the advantages of a dial indicator is manufactured by Federal Products Corp., Providence, R. I. It can be used as a dial indicator-comparator without the necessity of setting to a master; the micrometer furnishes the precision setting.

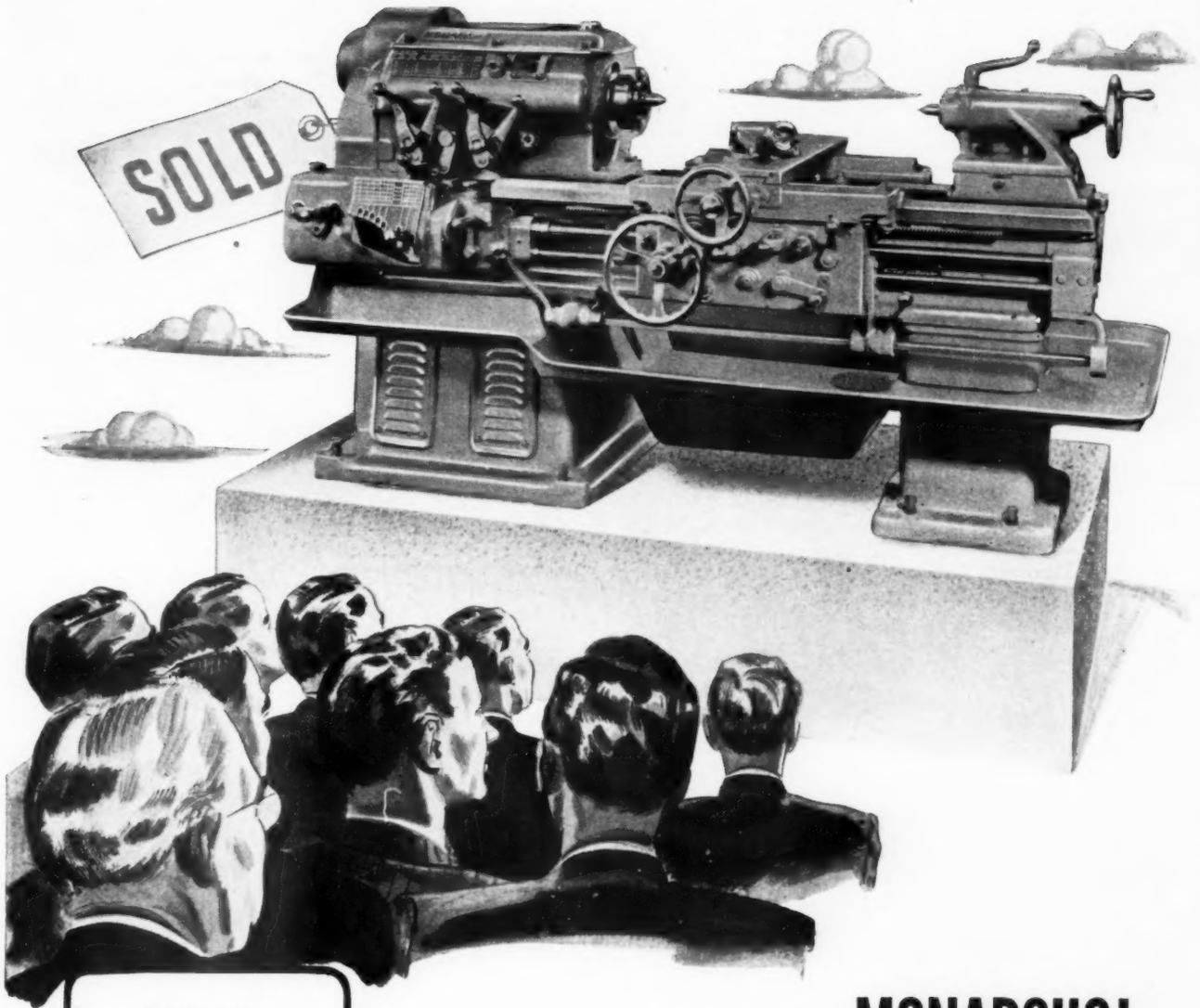
As a micrometer, the spindle can be brought in contact with the work until the indicator hand indicates 0-0, and the measurement is then read in the barrel and thimble. As an indicating comparator, it can be set to the nearest thousandth of an inch, and the variation from that setting can then be read on the instrument dial.

In both the above cases, anvil pressure is constant and accuracy of the instrument is independent of feel. The use of the micrometer as a comparator makes it advantageous for short runs and as a direct-reading instrument where frequent changes occur in dimensions and tolerances. A single micrometer can replace a complete series of ordinary go and no-go gages.

The instrument is light, easy to handle and easy to read. The indicating dial is integral with the frame and provided with tolerance hands, which can be set with the wrench furnished with the gage. The micrometer scale and the indicating dial are graduated in 0.0001 in. and measuring capacity is 0-1 in. When used as a comparator, the measuring spindle is locked in the desired position by a thumb clamp which grips evenly, and does not throw the spindle to one side or out of line. The opposite anvil is retracted by pressure on the finger or



The Federal indicating micrometer, 200P-1, is finished in dull chrome which is suitable for ease in reading the dial and protects the instrument from rust



Reasons for Monarch Popularity!

- Flame-hardened and ground bedways
- Hardened and ground parts throughout
- Anti-friction bearings
- Force-feed lubrication
- High spindle speeds
- Easy, convenient controls
- Automatic sizing
- Taper turning attachments
- Monarch-Keller controls
- Accessories to cut costs and widen range of work

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

EVERYBODY WANTS MONARCHS!

"SOLD" signs appear quickly on Monarch Turning Machines, whenever they are listed at surplus machine tool sales. Alert buyers recognize Monarch's ability—proved in the grueling grind of wartime service—to retain their original accuracy, speed and high quality of production.

They know that flame-hardened and ground bedways and bearing surfaces, anti-friction bearings, force-feed lubrication and other important features enable Monarchs to turn more and better work at lower cost . . . for a long time.

So, when you hear of a surplus Monarch, you'd best move quickly. Ask our nearest office to check the machine with you, and to tell you about accessories and tooling that will help you gain the greatest benefit from your purchase. There is no cost or obligation for this service, so use it freely.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

FACTORY BRANCHES:

622 West Washington Blvd. Chicago 6, Ill.
801 Fisher Building Detroit 2, Mich.
10465 Carnegie Ave. Cleveland 6, Ohio
635 Industria Office Bldg. Newark 2, N. J.
512 Empire Building Pittsburgh 22, Pa.
38th and College Ave. Indianapolis, Ind.

Representatives in Principal Cities

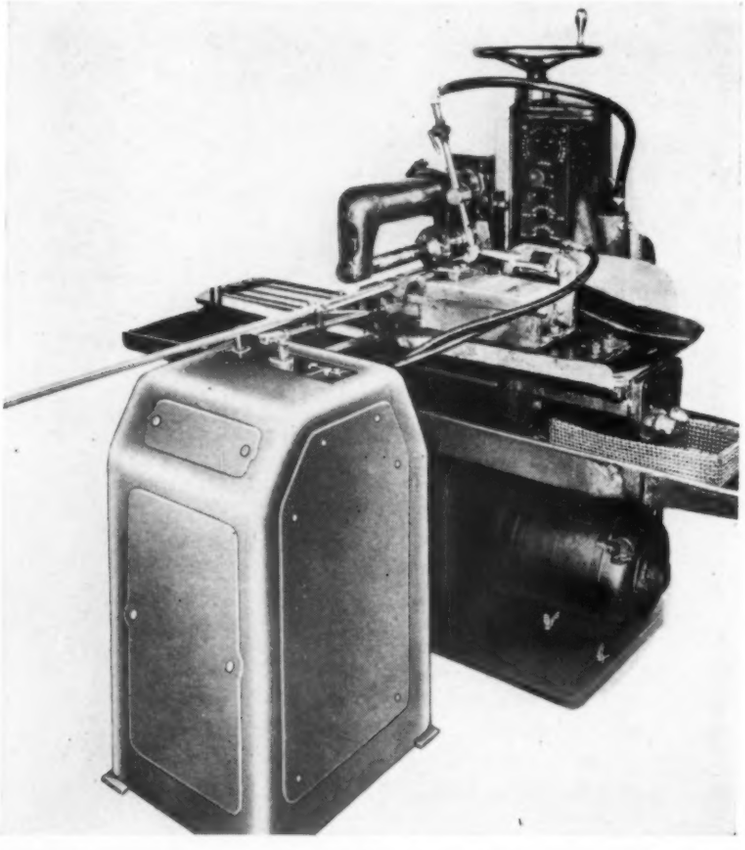
thumb button. This enables the workpiece to be inserted with less chance of the anvils scratching the work. It also prevents excessive wear on the anvils. Both contact faces are tungsten-carbide tipped, and are lapped parallel. The retracting mechanism operates separately from the movement and cannot influence the reading.

Pond Operator Unit Makes Machine Control Automatic

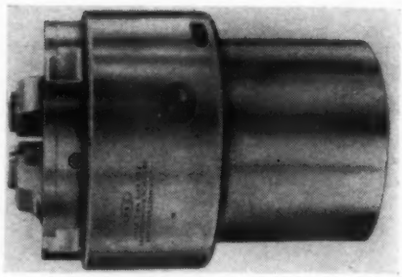
The Pond Engineering Co., 15 Park St., Springfield, Mass., is the producer of a machine-tool attachment that mechanizes hand-controlled machines and provides completely automatic operation. Its function is that of eliminating the manual element in feeding, locating, clamping, advancement of work to tool and removal of finished work, making possible the assignment of two to six machines per attendant, depending upon the type and size of magazine, hopper, bar or other feed concerned.

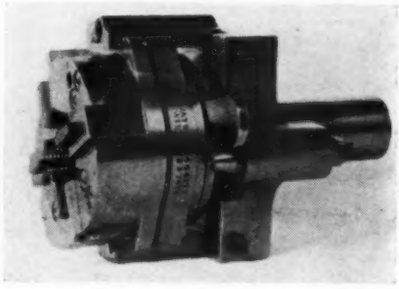
The Pond Operator is a mechanical, pneumatic control unit. Adjustable cams actuate levers and pneumatic valves which control feed mechanisms and pneumatic cylinders. The levers and cylinders apply the impulses required at the various points on the machine tool and the feed to afford full-automatic functioning.

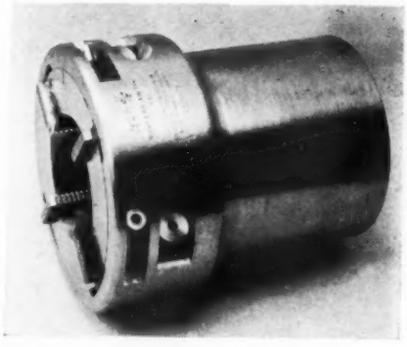
The device is housed in a cast-aluminum case with well access hatches. It can be quickly detached when hand control is desired for small runs. It can be moved from one machine to another to accommodate different jobs.



The Pond Operator is manufactured in two models, No. 200 for heavy work such as bar feed cross-milling on standard millers and No. 600 for lighter work and secondary operations such as drilling, tapping, reaming, slotting, counterboring and grinding. The operator can be attached to any machine tool and to its workholding fixtures to make the operation fully automatic





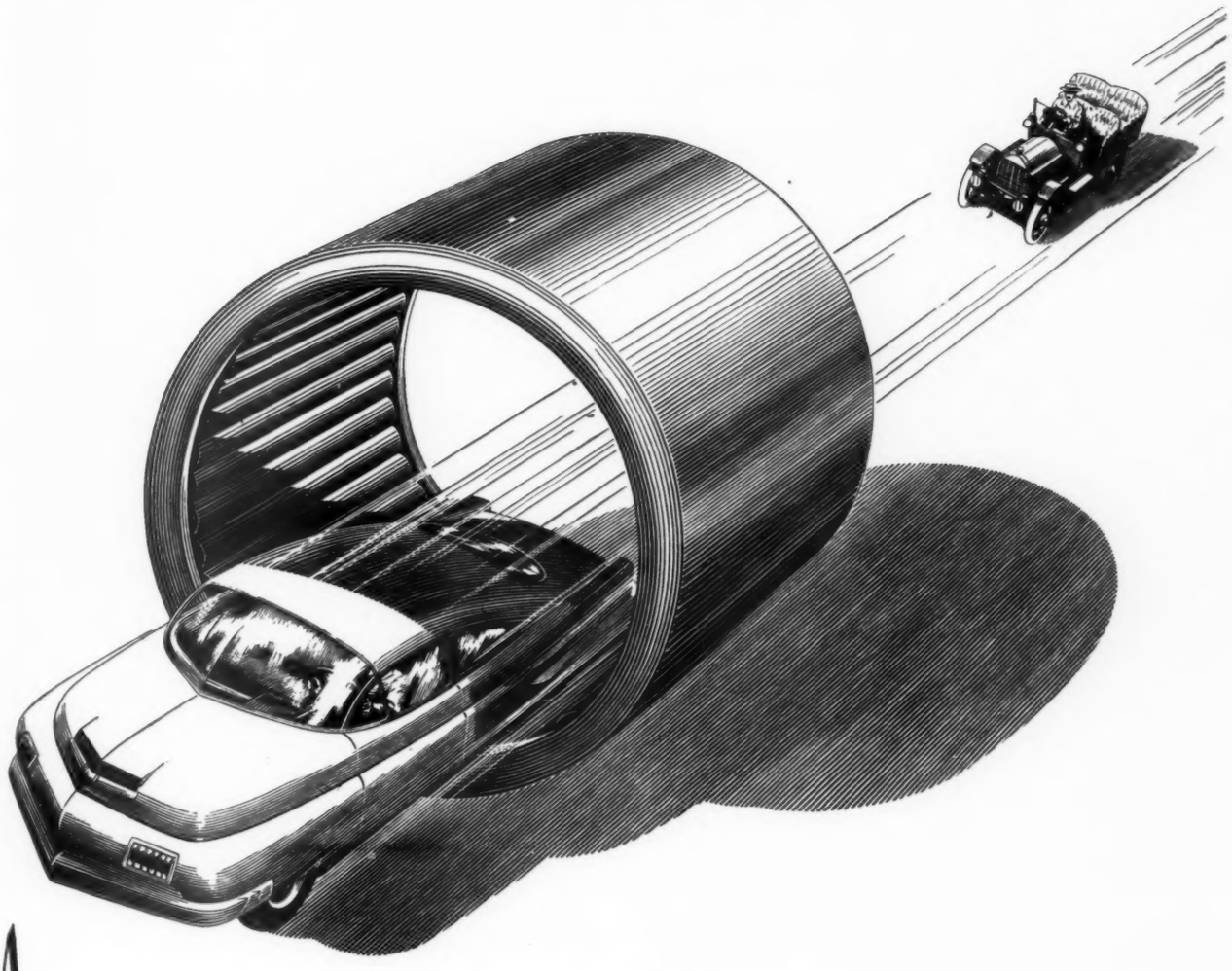


Three Eastern Dieheads Fit Standard Machine Tools

The Eastern Machine Screw Corp., New Haven 6, Conn., has developed a solid adjustable-insert chaser diehead for Goss & DeLeeuw double-threading chucking machines, known as Style SMM, Size 103. The head takes the same carrier as the 103 size of opening dieheads, and has a normal thread range up to 1¼ in. dia., 3 in. long. The shank fits over the spindle of the machine, thus permitting tapping while threading.

Style DMT insert chaser diehead is for use on Brown & Sharpe automatics for cutting taper pipe threads. The head opens gradually to form the taper and eliminates the marks along the thread usually present on a jam-cut taper thread.

A solid adjustable head using insert chasers, Style SAM, is designed with a shank that fits over the spindle of the Goss & DeLeeuw double-threading chucking machine so tapping can be done at the same time. This head has light weight and minimum overhang.



Another Engineering Advancement that is Bringing Down Costs

Engineering methods and materials have come a long way since those days in the 'twenties when the "medium priced car" sold at $3,000. And each subsequent engineering advancement has contributed to better performance at lower cost.

That's what Torrington Needle Bearings are doing—*by providing anti-friction advantages and lowering costs all along the line...*

First costs are low because Needle Bearings are adaptable to precision production at low unit cost.

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And "last cost" is low: for the high capacity and efficient lubrication of Torrington Needle Bearings insure long service life. Needle Bearings never seem to wear out or require replacement.

If you are seeking improved performance at lower cost and are not fully aware of the possibilities of Needle Bearings, send for our Catalog No. 32 which gives a comprehensive picture of their many advantages.

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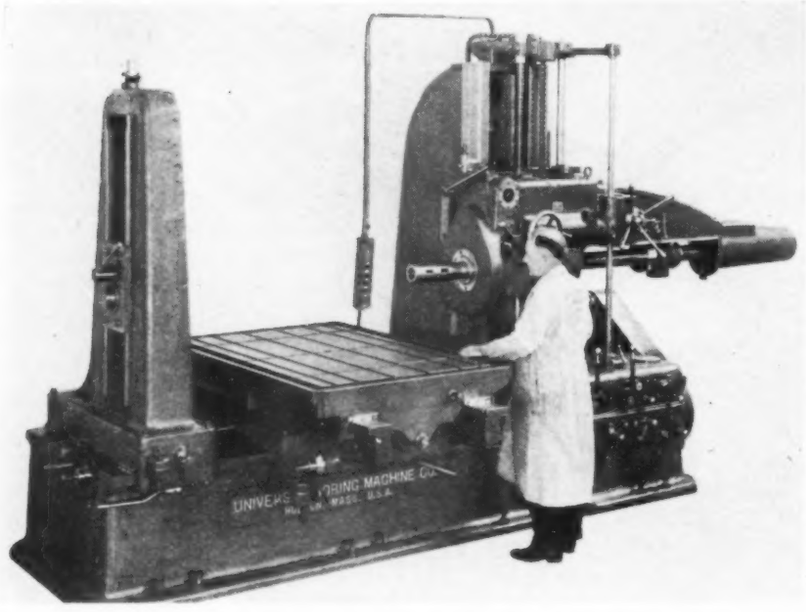


Control of the Universal boring machine is possible from any position within range of the swinging pendant station

The Universal Boring Machine Co., Hudson, Mass., now manufactures 4-in-spindle, horizontal, table-type milling, drilling and boring machines with a speed range of 8 to 1000 rpm. and 5-in. spindle machines 7 to 850 rpm. These machines are built in sizes 36, 48, or 60 in. vertical range; 72, 96 or 120 in. faceplate to outer support; 40x60-in., 42x72-in., or 48x84-in. table size as necessary.

Electrical equipment comprises a 20-hp. motor, which is controlled through a swinging pendant push-button station, giving forward, forward jog, reverse, reverse jog and stop. Anti-friction bearings are provided throughout the speed gears, and all gearing and shafts have been designed for heavy loads.

TRADE PUBLICATIONS

"1 Plastics Avenue"—(PH 518) is a colored brochure setting forth the services offered by GE in the field of plastics product design. A wide range of typical examples are shown indicating the problems which have been tackled and solved. General Electric Co., 1 Plastics Avenue, Pittsfield, Mass.

Plastics Design Data—(PH 519) is a short engineering manual tabulating basic physical properties of the standard range of industrial plastics. It also discusses conventional molding techniques and what can be done in the way of final machining. General Electric, 1 Plastics Avenue, Pittsfield, Mass.

Lead-Lined Valves and Fittings—gives technical information covering all phases of the use of lead-lined steel pipe, including full details and prices.

Lead-Lined Valves and Fittings—Two catalogs on lead-lined piping systems. The standard lines are fully illustrated and described, together with prices, and examples of special jobs are shown also. American Smelting and Refining Company, Lead Products Division, 120 Broadway, New York 5, N. Y.

Collets — 3-page illustrated folder gives general information about smooth and "diamond-grip" draw-in and push-out collets applicable to many machines. Sutton Tool Company, Sturgis, Mich.

Punch Press—Bulletin 51 is a detailed description of the R-5 turret punch press. It is particularly suited to short run production of such items as outlet boxes, conduit boxes and special plate work; its 12 stations provide a range of tools any one of which can be placed in position in 6 seconds. Wiedemann Machine Company, 1819 Sedgely Ave., Philadelphia 32, Pa.

Dynamometer — This brochure describes a sensitive deflection-beam instrument weighing less than 6 lb. with the largest dimension only 8 in. It is available in 9 capacities up to 10,000 lbs. Its construction makes it suitable for straight-line tension measurements anywhere that its two shackles can be inserted between the puller and the pulled. W. C. Dillon & Co., Inc., 5410 W. Harrison St., Chicago 44, Ill.

Strength of Materials—The Dillon Dynamometer is here the principal part of a testing machine only 37 in. tall weighing 132 lb., yet it measures tension or compression up to 10,000 lb. Accuracy is guaranteed within 2% of full-scale reading. Bulletin No. 142. W. C. Dillon & Co., Inc., 5410 W. Harrison St., Chicago 44, Ill.

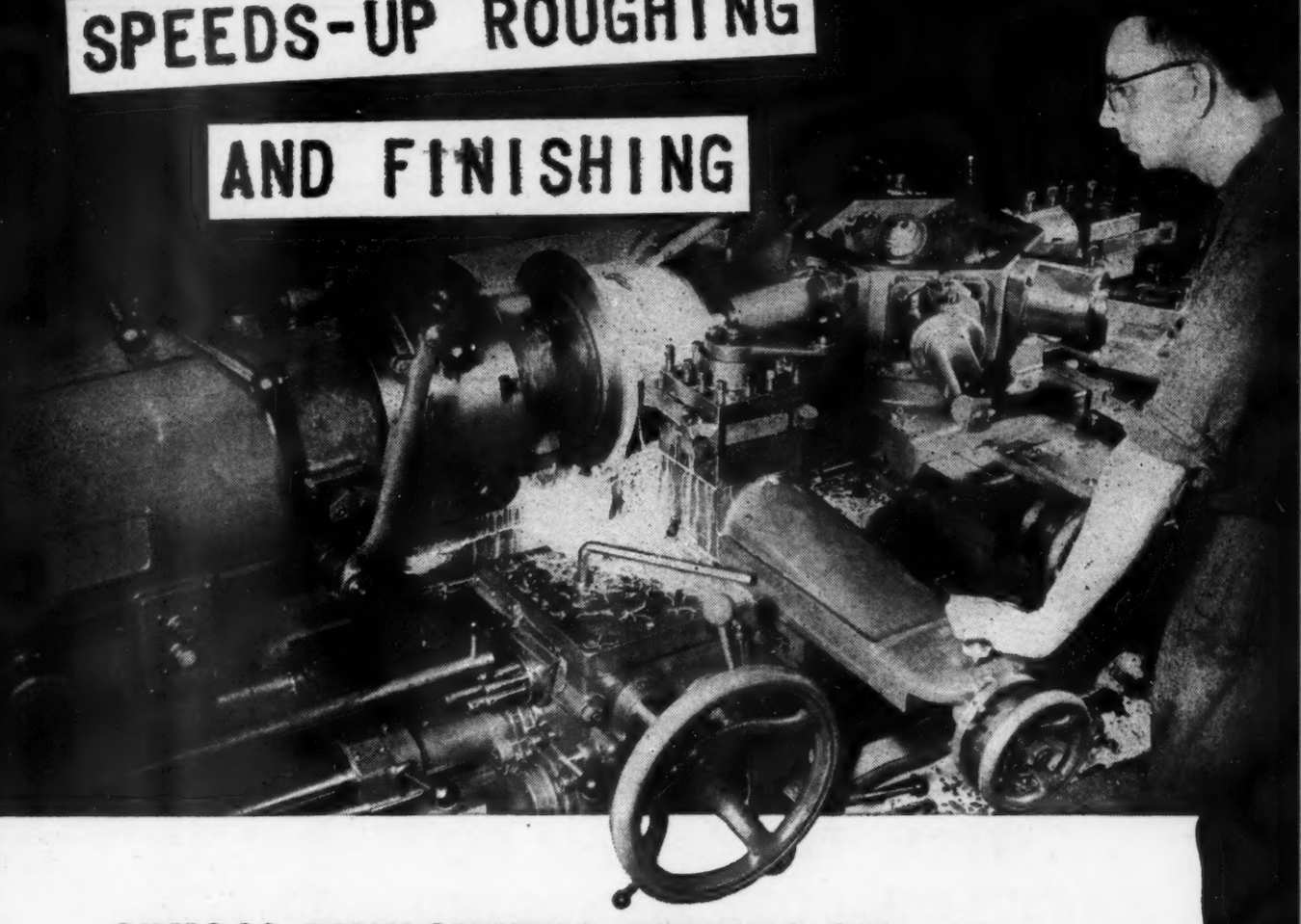
Watchmaker's Drills—4-page folder tabulates a range of twist and flat drills from 0.15 to 1.00 M/M (0.0059 to 0.0394 in.) in steps of 0.01 M/M. Whitman & Barnes, 2108 W. Fort St., Detroit 16, Mich.

Surface Grinder—Economical, precision, hand-fed surface grinder is described in a single page. H. Leach Machinery Co., 387 Charles St., Providence 4, R. I.

Special Machine Tools—Brochure describes and illustrates 16 custom-built machines from a 300-ton, 100-ft., milling machine to a special series of automatic machines for manufacturing electric flatirons. The company specializes in unusual tooling problems. The Ingersoll Milling Machine Co., Rockford, Ill.

Vertical Turbine Pumps—Bulletin H-450-B33 explains whiy this type of pump has proved itself on many jobs. Some models are self-contained; others are especially adapted with bevel gears for horizontal prime movers. Worthington Pump and Machinery Corporation, Harrison, N. J.

SPEEDS-UP ROUGHING AND FINISHING



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Production-engineers are keen judges of the performance of modern cutting-lubricants. Shown above is a case where the engineers picked Sunoco Emulsifying Cutting Oil to help speed-up roughing and finishing of high-carbon steel castings.

Operation:	Roughing and finishing 8½" wheel-hub
Machine:	Gisholt 2L production turret-lathe
Material:	High-carbon steel casting
Feed:	.017" roughing; .009" finishing
Spindle Speed:	29 R.P.M.
Surface Cutting-Speed:	64.5 feet per minute
Type of Tool:	Stellite
Cutting Lubricant:	1 part Sunoco to 20 parts water

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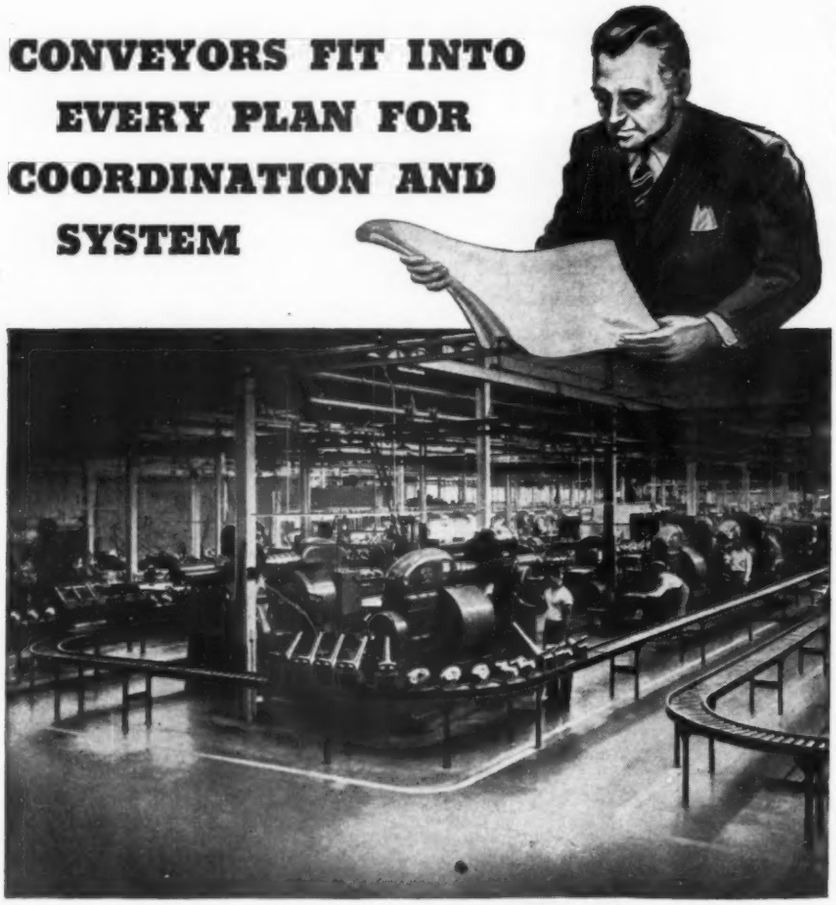

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TO THE EDITOR

SOUND DISCUSSIONS

In my estimation, Mark Purser's article, "Bearing Lands and Negative Rakes Prolong Tool Life," is one of the soundest discussions on a fundamental of machining practice that I have read.

I believe articles of this caliber should be made available to every person operating a machine tool. During this war millions of persons were trained to do a small number of jobs and do them well. A relatively small number had, or were trained in, the skill necessary for production of the vast amount of war material required. Fortunately the skill of these people was spread in such a manner that it was not necessary to train the larger number of workers in the fundamentals of machining practice. Nor was it possible to train them thoroughly due to lack of time.

Workers are taught safety and various other things through the medium of bulletin boards. Why can't they be taught the fundamentals of machining practice the same way? I would suggest that a survey be made of the various manufacturing plants in this country to find out if management would cooperate in an educational program whereby articles such as Mr. Purser's would be reprinted and displayed on bulletin boards in the various machining departments.

C. W. Harris,
Screw Machine Products
& Engineering Company

VETOES ANNUAL WAGE

The idea of a guaranteed annual wage in the metalworking industry, as outlined recently in the Foreman's Round Table, is theoretically nice if you can afford it. I doubt if many metalworking companies could afford it and remain in business. Rather than just dismiss the idea, however, other methods of employment security might be applied advantageously.

At present there is little, or at least not enough, incentive for a manufacturer to minimize the hire-and-fire rate. In New York State, he pays the same per capita rate of unemployment insurance regardless of the rate of labor fluctuation in his factory. It would appear worthwhile to reward the manufacturer with low labor fluctuation by reducing his unemployment insurance rate.

THIS VERSATILITY

Also Has Many POSTWAR USES

The myriad requirements of war demonstrated the amazing versatility of Vickers Hydraulic Controls. There were so many kinds of jobs to do—jobs which had to be done better than ever before—jobs which had never previously been accomplished.

For example, in this illustration, the plane has Vickers Hydraulic Control for brakes, automatic pilot and cargo door operation. The lift trucks have Vickers Hydraulic Control which lifts and positions the load accurately at the finger-touch of the operator. The graders building air fields use Vickers Hydraulic Power for steering front and rear wheels, raising, lowering or side shifting the blade, and operating the attachments.

These are just a few of the war jobs Vickers Hydraulics have done. Others include the precision movement of heavy battleship turrets—the automatic aiming of anti-aircraft guns—the fast precision positioning of ammunition hoists—the control of bomber gun turrets—and others which, cannot yet be described.

VICKERS HYDROMOTIVE EQUIPMENT

Many of the intricate machine tools that produced the machines that won the war depended for their accuracy, production speed, and ease of operation upon Vickers Hydraulic Controls.

This demonstration of the remarkable versatility of Vickers Hydraulic Controls suggests many new applications to a wide variety of postwar equipment.

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This leads to steps for minimizing labor fluctuations. A small tool and die shop in Buffalo accomplished this by developing a standardized line of perforating tools to fill gaps between special-tool orders. Although profits on stock items are not as great as on special-job orders, it served to keep the plant personnel busy. With proper incentive, many other companies would try to develop less-profitable sidelines rather than resorting to the easier course of just laying off employees.

A guaranteed annual wage might be medicine to cure present ills but it might kill the golden goose eventually via bankruptcy. Attempts to stabilize employment should be gradual and offer an economic incentive. The annual wage guarantee may be adaptable to some companies at this time, but the most that can be expected from a majority of metalworking companies is a wholehearted effort to minimize but not eliminate employment fluctuations. J. W. Marcille, Mechanical Engineer.

SCHEDULED MAINTENANCE

In connection with the Foreman's Round Table topic of scheduled maintenance, it might be well to point out that maintenance is everybody's business. Every plant expanding its manufacturing facilities goes through a small revolution caused by departmentalization of plant functions.

Your man Al sounds like one of the small shop men who took care of all details in his department including the maintenance of machinery. This is accepted practice and works well as long as Al is not too busy to keep it up. Al, however, does not realize that he cannot serve two masters.

The modern plant is highly specialized in its functions and requires specialists to operate it. Two schools of thought exist on maintenance. One believes in running a machine until it falls apart and then sending it to the repair department to be rebuilt. The second believes in keeping machines in condition approximating that of their original purchase. The second school of thought will be found in the more progressive shop.

Modern machine tools are rugged, powerful and built to such precise limits that their care cannot be left in the hands of the so-called all-around mechanic. Important working parts run on super-precision, preloaded ball bearings that require special techniques and tools to keep them in their original condition.

Keeping machines in good condi-

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tion should not be left entirely to the maintenance department. It should be a function of all parties concerned. The chief maintenance man, Robin Hood, should not be permitted to enter a department and shut down machines for repair without regard to production schedules and machine loads. He and Al should work together in some manner so that both perform their jobs without too much upset. When a machine needs specific repairs, they should agree on the best time for making them.

Maintenance department inspections have been curtailed through the war for lack of manpower. With the return to normalcy, progressive plants will resume regular routine inspections and catch the little things before they turn into big ones. Teamwork, cooperation and preventive maintenance can pay important dividends if given the chance.

Charles E. Livingway
Detroit, Mich.

ANNUAL WAGE

The question of "How About An Annual Wage?" expounded in the Foreman's Round Table cannot be discussed intelligently until a few fundamental facts are recognized and given honest consideration.

1. Every person usefully occupied is a laborer and entitled to the same rights as any other laborer, and no more. The fact that laborers organize into a group does not entitle them to special privileges denied others.

2. All exchangeable goods or services are produced by labor. There is no other source of wealth. The value of any goods or services depends on the value of labor producing them. Labor's value can only be determined by the law of supply and demand, which in turn cannot function without free competition and the right of each individual to bargain for the exchange value of his services.

3. Specialization makes it necessary for all laborers to exchange some of their labor or the products of their labor for that of other laborers. This is business and it is by this process that laborers employ each other. Full employment depends on each laborer giving as much value as he receives. Slowdowns and retarded production cannot produce full employment.

4. So-called "Capital or Management" is not the employer of labor, but merchants who buy labor and sell the products of labor to other laborers who in turn produce other goods or services with which to buy. For laborers to expect management to guarantee them an annual wage would be like asking the grocer to guarantee the farmer an annual income because he buys and sells the farmer's produce. When a laborer asks for a guaranteed annual wage, he should remember that his employer is also his employee and that he should not expect as an employee to get more than he is willing to pay as an employer.

5. The only reason we have a higher standard of living than the Chinese or even the English, is the fact that we can produce more per man per hour, and we can do this because we have better tools, better methods and better management. We have these things not because of, but in spite of organized labor, which has consistently opposed production incentives and labor-saving devices.

6. Employment is not static but cumulative. If "A" is unemployed for any reason, he has not only lost his own employment but he has lost his ability to employ "B" and the latter will also be unemployed, since "A" has produced no goods with which to employ "B."

Until we all learn and recognize that the things we want cannot be bought with money unless they are produced, our standard of living will decline regardless of the amount of money involved. It is our standard of living rather than the amount of our wage with which we should be concerned.

Allen J. Patch,
Consulting Engineer
Duluth, Minn.

JOB EVALUATION

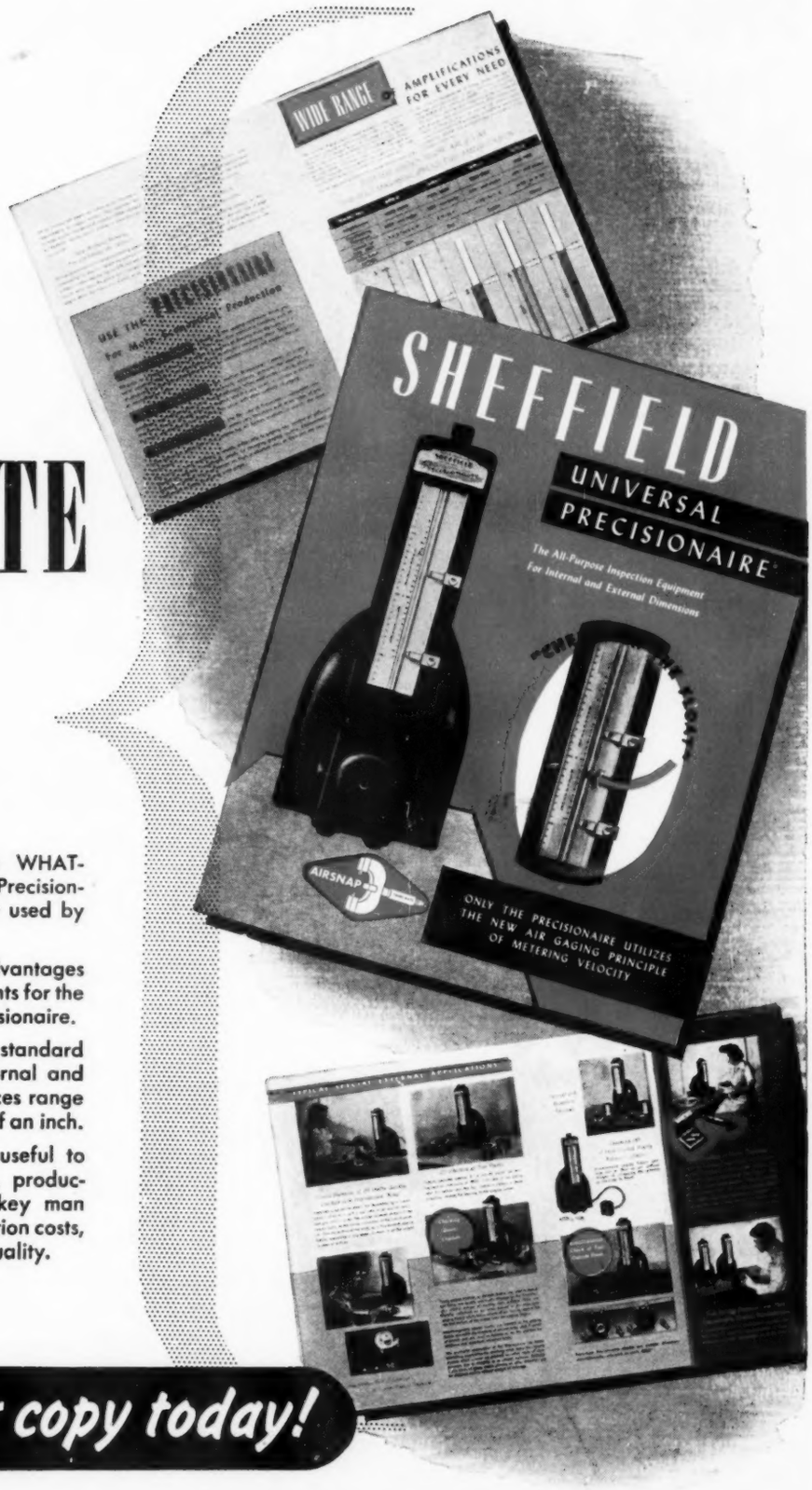
The problem of "Job Evaluation" can be divided into two parts and must be handled accordingly: 1. Job evaluation of the Foreman's work and 2. A job qualification card for the Foreman.

Job evaluation is the operation of analyzing a particular job with respect to other jobs. This determines the requirements of a job and establishes a suitable base rate for the position.

Correct evaluation of a specific job makes possible the establishment of a suitable differential between the wages of foreman and worker. It serves to place each foreman on his correct rung of management's ladder.

A job qualification card on each foreman serves as a guidepost in selecting understudies for training. Qualified men will save tremendous sums of money which will be lost should a misfit be named to an important post. These qualification cards should be made out the day a man is hired and become a part of his employment record.

COMPLETE TEXT ON AIR GAGING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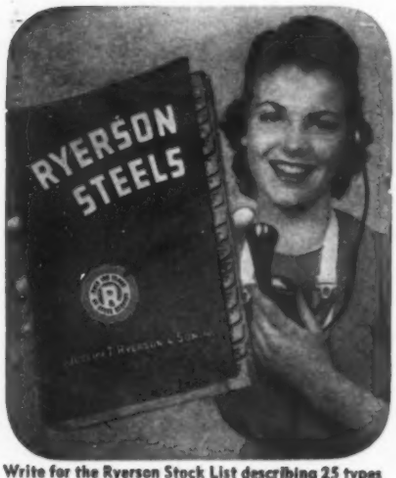
25 types of Allegheny Stainless . . . a wide range of sizes in sheets, plates, bars, tubing, pipe, etc. . . . are ready at Ryerson for your present production and postwar planning. Careful handling and storing insures perfect condition of Allegheny Stainless from Ryerson stocks.

Careful handling and storing insures perfect condition of Allegheny Stainless from Ryerson stocks.

To help determine the best types for your use and how best to fabricate or apply them, technical help is available on small orders as well as large. Ryerson has stocked Allegheny Stainless exclusively since 1925 as the finest of stainless steels. The rich experience gained since that time is at your disposal.

Ductility determinations of stainless sheets are made on the Erichsen machine in a Ryerson laboratory.



Write for the Ryerson Stock List describing 25 types of Allegheny Stainless and other steels in stock.

11 conveniently-located Ryerson plants bring this complete service on Allegheny Stainless as close as your telephone. Write the plant nearest you for Stock List and Steel Data Book. Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

RYERSON

Specifically, job evaluation and job qualification for management are important "musts" in any modern business. Only by satisfactory use of these tools will management be able to sit at the bargaining table with labor and expect to win. All foremen are a part of management.

All non-productive jobs can be rated as closely as productive jobs. The fact that these jobs have not as yet been rated is only a sign of neglect, not of failure.

Better work is more important than a good outside offer to most workers. In their rank of importance the following factors show that people do not consider wages the most important item to be considered when evaluating their job.

1. Steady work
2. Comfortable working conditions
3. Chance of promotion
4. High pay

There is a definite lowering of company-wide morale when one foreman gets a raise by using the "squeeze" method. Only poorly managed companies will submit to this practice. Actually if a man is paid what he is worth there is no chance for a squeeze. Proper use of understudies will limit this practice since a new man will be available should a foreman step out.

Leon V. Whipple

Microscopic Screw Threads

Users of standard coarse and fine pitch threads frequently think they have troubles with tolerances which are hard to maintain. But if they want real headaches they should study the threads used by watch and instrument makers, for which standardization is now being attempted. The instrument screws used in different parts of the world vary from the 47½° angle of the British Assn. to 50° for some systems and 60° for others.

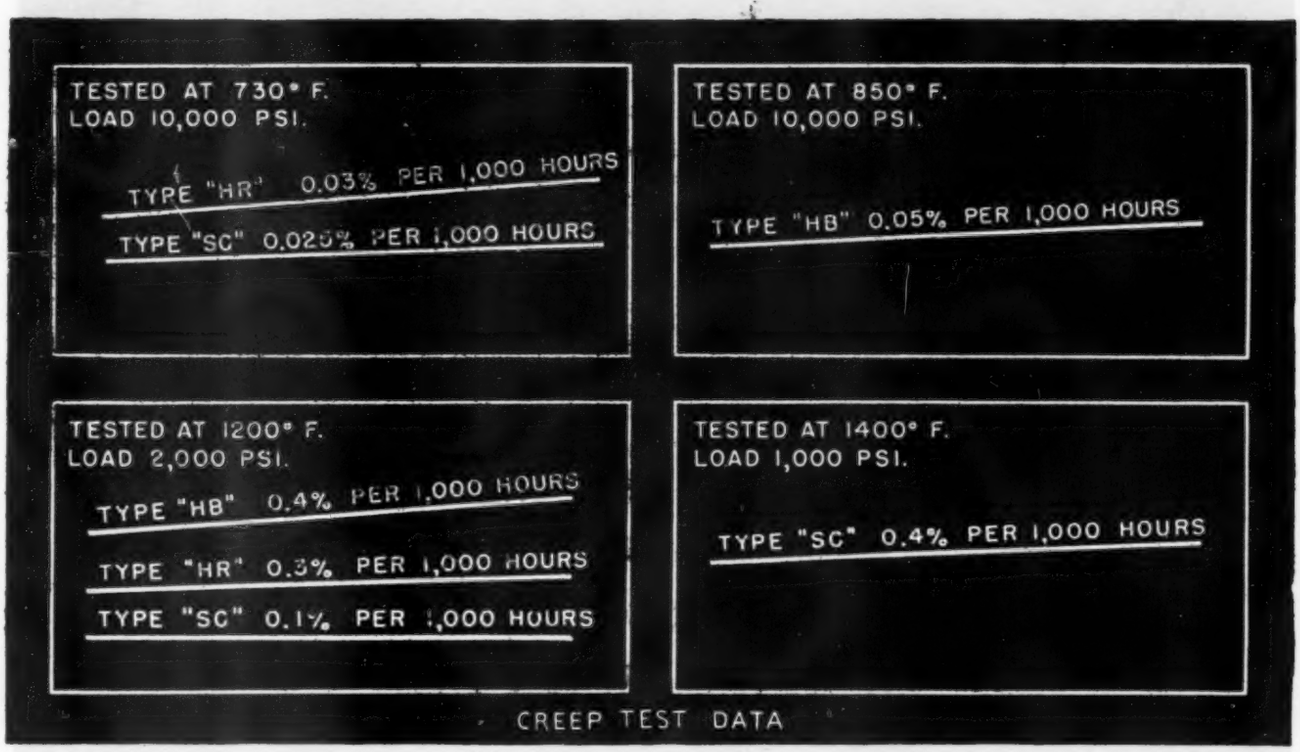
The screws are made in both inch and metric measurements and in pitches from 113 to 340 threads per inch, the smallest being a little less than 0.01 in. in the minimum diameter with a tolerance of about a half-thousandth. These are flat-topped threads, some of the flats being less than 0.001 in. wide. Some users feeling that to make a flat less than 0.0004 in. is getting it a little too fine, and they seem to have a good case.

Drilling holes for such taps is a fussy job although the watch companies drill thousands of these holes every day. They have to allow for the metal flowing up into the thread as the taps lose their keen edge. In some cases they find that the actual engagement between a maximum hole and minimum screw is about 0.001 in.

MEEHANITE CASTINGS

HEAT RESISTING TYPES

Maintain Strength Properties at Elevated Temperatures


TESTED AT 730° F.
LOAD 10,000 PSI.
TYPE "HR" 0.03% PER 1,000 HOURS
TYPE "SC" 0.025% PER 1,000 HOURS
TESTED AT 850° F.
LOAD 10,000 PSI.
TYPE "HB" 0.05% PER 1,000 HOURS
TESTED AT 1200° F.
LOAD 2,000 PSI.
TYPE "HB" 0.4% PER 1,000 HOURS
TYPE "HR" 0.3% PER 1,000 HOURS
TYPE "SC" 0.1% PER 1,000 HOURS
TESTED AT 1400° F.
LOAD 1,000 PSI.
TYPE "SC" 0.4% PER 1,000 HOURS
CREEP TEST DATA

MEEHANITE FOUNDRIES

Allentown, Pa.	Traylor Engineering & Mfg. Co.
Ansonia, Conn.	Farrel-Birmingham Co., Inc.
Birmingham, Ala.	The Continental Gin Co.
Bridgewater, Mass.	The Henry Perkins Co.
Brooklyn, New York	E. W. Bliss Company
Buffalo, N. Y.	Pohlman Foundry Co., Inc.
Charleston, W. Va.	Kanawha Manufacturing Co.
Chattanooga, Tenn.	Ross-Meehan Foundries
Chicago, Ill.	Greenlee Foundry Company
Cleveland, Ohio	Fulton Foundry & Machine Co.
Denver, Colo.	The Stearns-Roger Mfg. Co.
Detroit, Mich.	Atlas Foundry Co.
Flint, Mich.	General Foundry & Mfg. Co.
Hamilton, Ohio	The Hamilton Foundry & Machine Co.
Hamilton, Ontario	Otis-Fensom Elevator Co., Ltd.
Irvington, N. J.	Barnett Foundry & Machine Co.
Jeannette, Pa.	Elliott Company
Los Angeles, Calif.	Kinney Iron Works
Milwaukee, Wis.	Koehring Company
Mt. Vernon, O., Grove City, Pa.	Cooper-Bessemer Corporation
Newark, N. J., Peoria, Ill.	M. H. Detrick Co.
New York, N. Y., Mahwah, N. J.	The American Brake Shoe Co.
Oakland, Calif.	Vulcan Foundry Company
Orillia, Ontario	E. Long, Ltd.
Philadelphia, Pa.	American Engineering Company
Philadelphia, Pa.	H. W. Butterworth & Sons Co.
Philadelphia, Pa.	Florence Pipe Foundry & Machine Co. (S. D. Wood Company, Selling Agents)
Phillipsburg, N. J.	Warren Foundry & Pipe Corp.
Pittsburgh, Pa.	Rosedale Foundry & Machine Co.
Portland, Oregon	Crawford & Doherty Foundry Co.
Rochester, N. Y.	American Laundry Machinery Co.
St. Louis, Mo.	Banner Iron Works
St. Paul, Minn.	Valley Iron Works
Seattle, Washington	Washington Iron Works
Spokane, Washington	Washington Machinery & Supply Co.

FACTS, FIGURES, DATA, AVAILABLE AND RELIABLE FOR THE USERS OF MEEHANITE CASTINGS

Creep is a measure of the slow deformation which a metal undergoes at a given temperature under a specified stress. It is frequently expressed as creep rate—percent total elongation per 1000 hours.

Creep tests are radically different from tensile tests made at elevated temperatures. Such tensile tests are usually made after heating a test piece for one hour or so, whereas creep data are frequently obtained from tests run for 2000 hours or more.

A series of creep tests made on heat resisting types of Meehanite at various temperatures and stresses are illustrated. These show the high temperature serviceability of Meehanite over the temperature ranges of 730°F. to 1400°F.

For further information concerning Meehanite heat resisting applications, write for Bulletin No. 21 "Meehanite —the Metal for Heat Resisting Castings."

MEEHANITE RESEARCH INSTITUTE

New Rochelle, N. Y.

Perpetual Inventory of 4000 Items operated quickly and easily by ONE GIRL . . . with McCASKEY CONTROL

The perpetual inventory system, adopted by Federal Manufacturing & Engineering Corporation, Brooklyn, N.Y., to meet an increasing rate of turnover in stocks of production materials and parts, is described by Mr. E. N. Reynolds, Production Control Manager, in the November issue of Factory Management and Maintenance.

All the work of this system, characterized by speed and simplicity, is done by one girl.

Objectives of System:

. . . to provide production men with the current status of the stockroom at all times

. . . to assure against shortages of parts or material when orders for go-ahead in production are issued

. . . to provide a system showing the stockroom's status in *visual form.*

Accomplishments

These objectives were achieved and the problem solved to the satisfaction of both production and accounting departments by the installation of McCaskey Inventory Control with the following advantageous results:

. . . changes in stockroom supplies are now shown within a matter of minutes

. . . operation of the system which controls thousands of items requires the services of only one girl clerk

. . . simplicity of the system makes it possible for anyone in the office to ascertain the status of any item in inventory *at a glance* without calling on the operator of the system to interpret it.

. . . new or substitute operator quickly trained.

Details of this system and how its advantages are being achieved are contained in a 4-page reprint of the complete article, "One-Girl System Provides Perpetual Inventory" . . . available promptly on request. Write us for your copy.

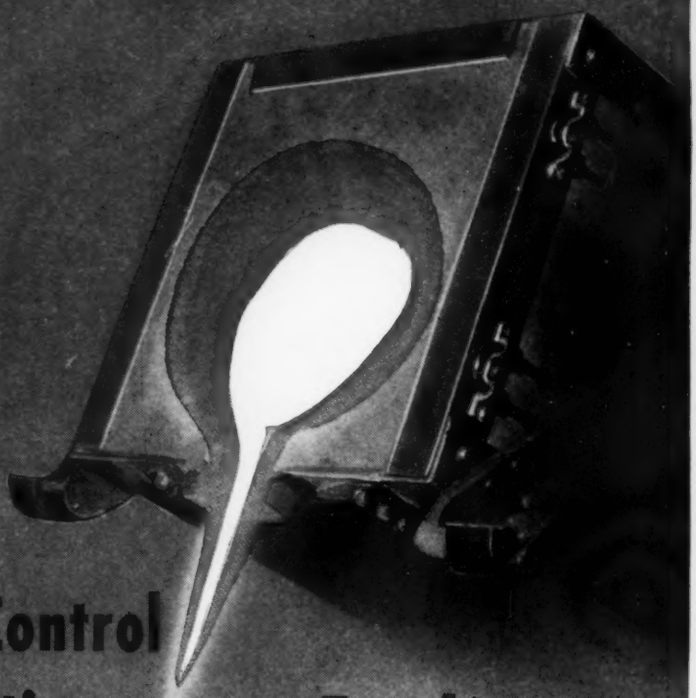
THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

The Secret of Nichrome* Superiority



Precise Metallurgical Control from Furnace to Casting

To produce genuine Nichrome takes more than the combining of the two metals, Nickel and Chromium. It requires specialized techniques to make this superior high heat and oxidation resisting alloy; the same technique essential in the production of the malleable grades of Nichrome as used in industrial and electrical appliances.

Through every stage of manufacture, from the first melting of the metals to the final machining of the finished casting, precise metallurgical checks and controls operate to assure the peerless and enduring qualities of Nichrome.

These exclusive Driver-Harris quality controls represent 45 years of continuous alloy research. No wonder, therefore, that Nichrome is the time-tested standard by which other heat-resisting alloys are measured. Although there are many excellent nickel chromium combinations, there is *only* one NICHROME—and it is made *only* by Driver-Harris.

For full technical information regarding D-H Nichrome, write for copies of the booklets entitled, *Nichrome—Chromax—Cimet* and *Work Holding Fixtures for Pit-Type Furnaces.* They will be valuable additions to your reference files.

Driver-Harris manufactures a complete line of heat-treating equipment from furnace parts to rotary retorts. Send us your specifications.

D/H SPECIAL PURPOSE ALLOYS SINCE 1888

Famous for **NICHROME***

Driver-Harris COMPANY

HARRISON, N. J.

Branches: Chicago • Detroit • Cleveland
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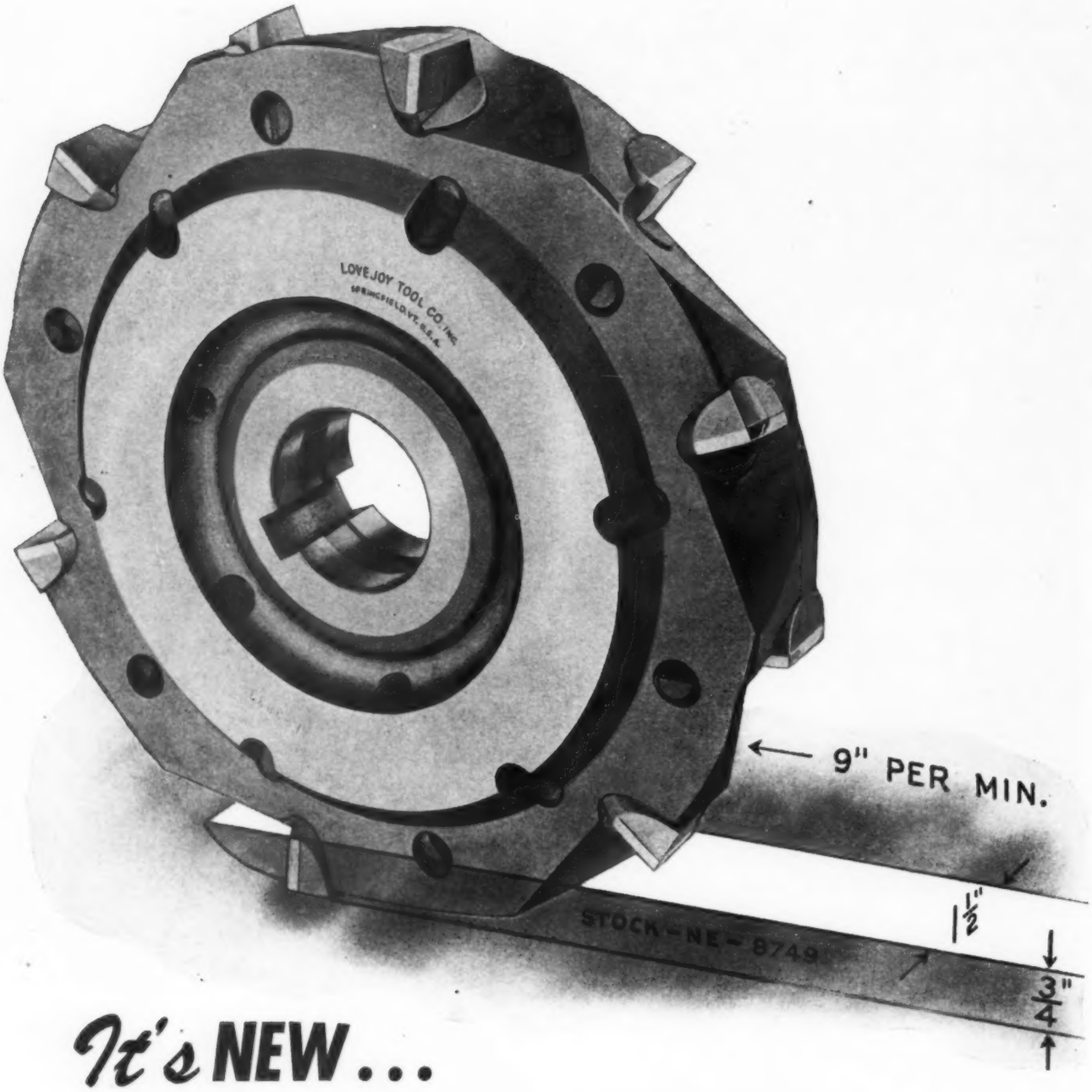
† Manufactured under Driver-Harris Patent No. 2,230,310



It's NEW...

THE LOVEJOY TYPE "F" SLOTTING CUTTER

If the machine can take it, you can bet the Lovejoy Type "F" Milling Cutter can take it too! Here is a modern, husky, negative rake cutter that will hog out slots in tough stock as though it were cheese. Note the rugged proportions—the "positive-locked" Lovejoy blades are set deeply into the tough steel housing. This, plus the fact that there is plenty of chip clearance, offers progressive manufacturers a chance to make slotting cuts in a fraction of the time formerly required.

The body design is new, giving solid backing for TCT blade. Blade adjustment is new. Each blade is moved up by means of a recessed head screw. This gives fine width adjustment. Resharpened blades last longer. Note the extra large tip on the blades—another long life feature of the new Type "F".

Write for further details, and let our engineering department analyze your job requirements... and be sure to ask for Catalog No. 27.

LOVEJOY TOOL COMPANY, Inc. **Springfield, Vermont**

H-W Taps can take the punishment of speeded-up production. The "Hanson Process" . . . our exclusive method of finishing after hardening . . . insures against breakage due to strain and metal fatigue. H-W Taps have extreme accuracy . . . keener cutting edges for precise thread production . . . perfection of finish for longer runs between grinds. There's a H-W Tap for your every tapping need. Write or wire for descriptive literature.

Hanson Whitney

MACHINE COMPANY

HARTFORD • CONNECTICUT

THEY KNEW WHAT THEY WANTED

Big ideas take a lot of doing. When the builders of the power unit for the P-80, jet propelled Shooting Star, knew what they needed for the fastest fighter plane in the world, they knew where to get it so they came to Midvale for turbine rotor wheels. Hi-alloy, they had to be—and forged. Midvale immediately went to work and did its part successfully to put those super planes into the air; for Midvale knew what's known about hi-alloy steels. Count on it—Midvale preparedness and ability will stand up to advanced thinking and wide ideas where they concern special steels for unusual purposes.

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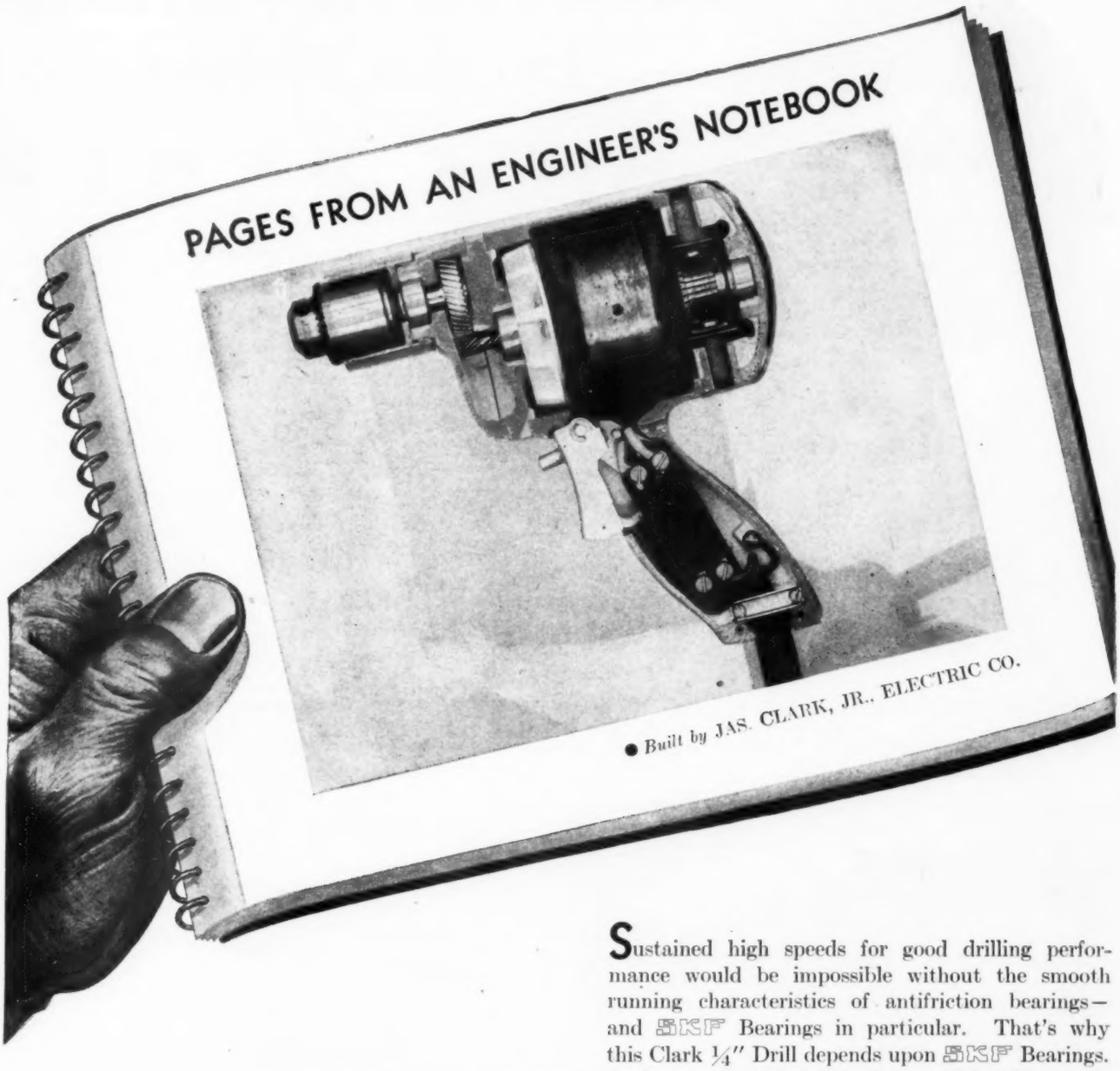
MIDVALE

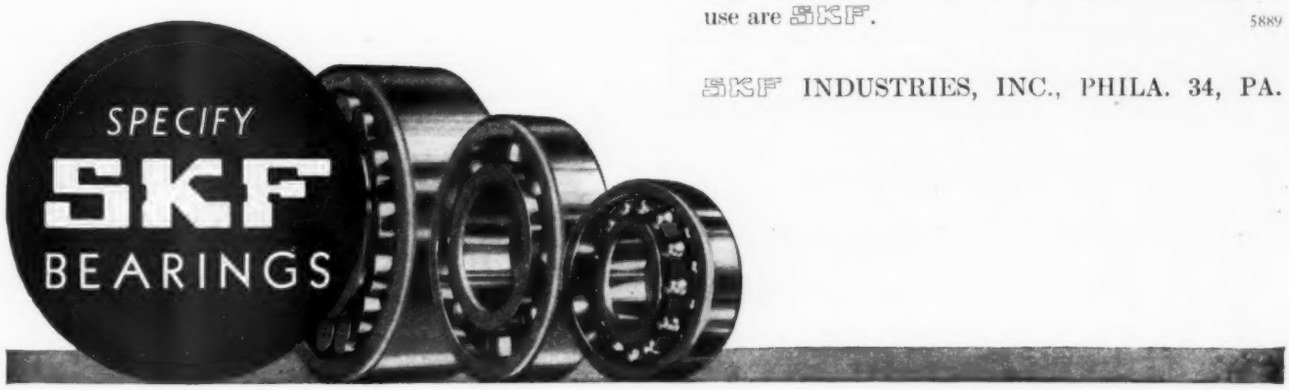
Custom Steel Makers to Industry



ACCURACY AT 2450 R.P.M.

Sustained high speeds for good drilling performance would be impossible without the smooth running characteristics of antifriction bearings—and SKF Bearings in particular. That's why this Clark ¼" Drill depends upon SKF Bearings. As it turns under full load at speeds of approximately 2450 r.p.m., SKF Bearings cling to their initial close tolerances, run smoothly and continuously. Designed with deep, uninterrupted grooves, SKF Bearings can carry combined radial and thrust loads in either direction. On any machine that removes metal, the bearings to use are SKF. 5889

SKF INDUSTRIES, INC., PHILA. 34, PA.



We hand you every advantage in the sphere of FLUSH FASTENINGS

ALLEN FLAT HEAD CAP SCREWS for perfect countersink-fit; positive wrenching

(1) Flush top surface with no gap between screw head and surrounding metal.

(2) Extreme rigidity of grip, because angle of head helps lock screw in place by drawing down on a conical surface.

(3) Firmer hold on thin plates of metal, by more binding surface under the head than in fillister type or cheese-head screws.

(4) Shallower countersink — less weakening of metal — when used for fastening a relatively thin plate.

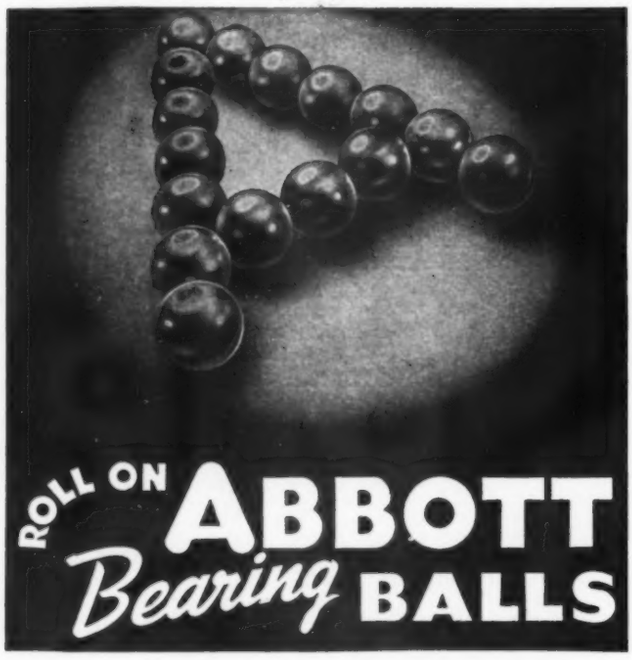
(5) Positive engagement of hex key transmits power for tightest of set-ups without slipping, reaming or side play.

(6) Maximum strength of screw itself assured by *"pressur-forming"* of special-analysis ALLENOY steel. Threaded to a high Class 3 fit.

(7) Speed in assembly provided for by use of Allen hand drivers and key blades for power drivers.

Order from your local Allen Distributor.

The Allen Mfg. Company ★ ALLEN ★ Hartford 1, Conn., U.S.A.



ROLL ON ABBOTT *Bearing* BALLS

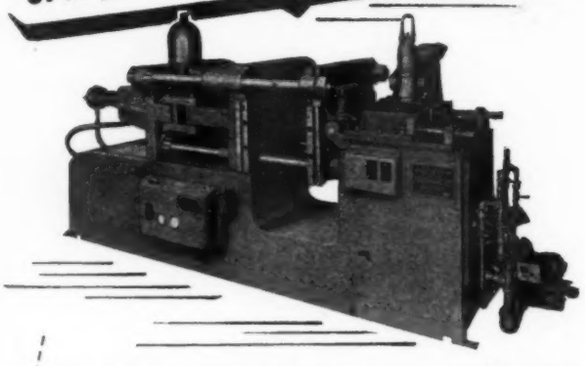
BE SURE OF UNINTERRUPTED PERFORMANCE

SPECIFY **"ABBOTT"**

THE ABBOTT BALL COMPANY
HARTFORD 10 CONN., U. S. A.

Availability!

KUX Produces the Most Complete Line of High Pressure Die Casting Machines



A size and model for every individual die casting need. 15 different types and sizes. Air operation or self-contained hydraulic operation. Automatic electrically timed casting cycle. Bullet-speed metal injection for densely consolidated castings. Safe, massively strong die plates and toggle mechanism.

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KUX MACHINE CO.
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COMMON SENSE ASSEMBLY ENGINEERING

ELIMINATES A "SPECIAL" FASTENING ...ADDS EXTRA SAVINGS!

Nor-Jay designed self-locking gas tank caps that met every market requirement. But they ran into troublesome, expensive assembly and decided to question the fastenings . . . special studs in the plastic cap, machine screws in the metal cap. The problem was up to a P-K Assembly Engineer.

Result – with P-K Screws they eliminate the special studs, add strength, save breakage of plastic caps, permit disassembly and eliminate blind tapping.

It's plain common sense to take a sharp look at fastenings in your product, whether it's in plan stage or production . . . common sense to start making the P-K savings you've been missing – often from 30% to 50% – by needless tapping, bolting, riveting, inserts in plastic.

A P-K Assembly Engineer will call at your request, or you can mail in assembly details for recommendations. Parker-Kalon Corporation, 208 Varick Street, New York 14, N. Y.

In both metal and plastic caps, three P-K Type "Z" Self-tapping Screws fasten the inside locking parts to the cap body, and another Type "Z" Screw secures the outside dust cap for the lock.

"HOW TO USE" Booklet – FREE. Get acquainted with the many types of P-K Self-tapping Screws and other Fastening Devices – learn how they cut assembly costs, improve products. Ask for Booklet No. 480.

SEE THE P-K EXHIBIT AT
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PARKER-KALON P-K SELF-TAPPING SCREWS

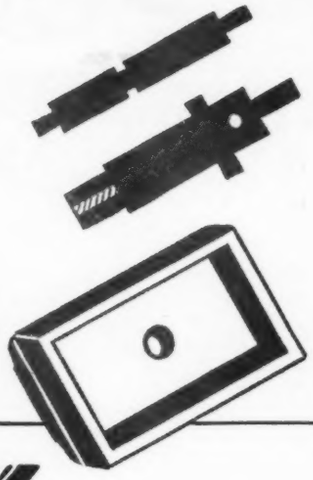
FOR EVERY METAL AND PLASTIC ASSEMBLY

NEED MACHINED CASTINGS?

Sibley is able to supply completely machined grey iron castings to your blueprints. This work should preferably be of small to medium size and in production lots.

Your schedule requirements and quality of work will be given paramount consideration.

Submit blueprints for quotation and in your reply, please refer to this advertisement.



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ALLOY STEELS FOR RECONVERSION

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Immediate shipment from seven conveniently located stocks.

Data sheets gladly mailed on request.

"THE HY-TEN OF TODAY IS THE STANDARD STEEL OF TOMORROW"

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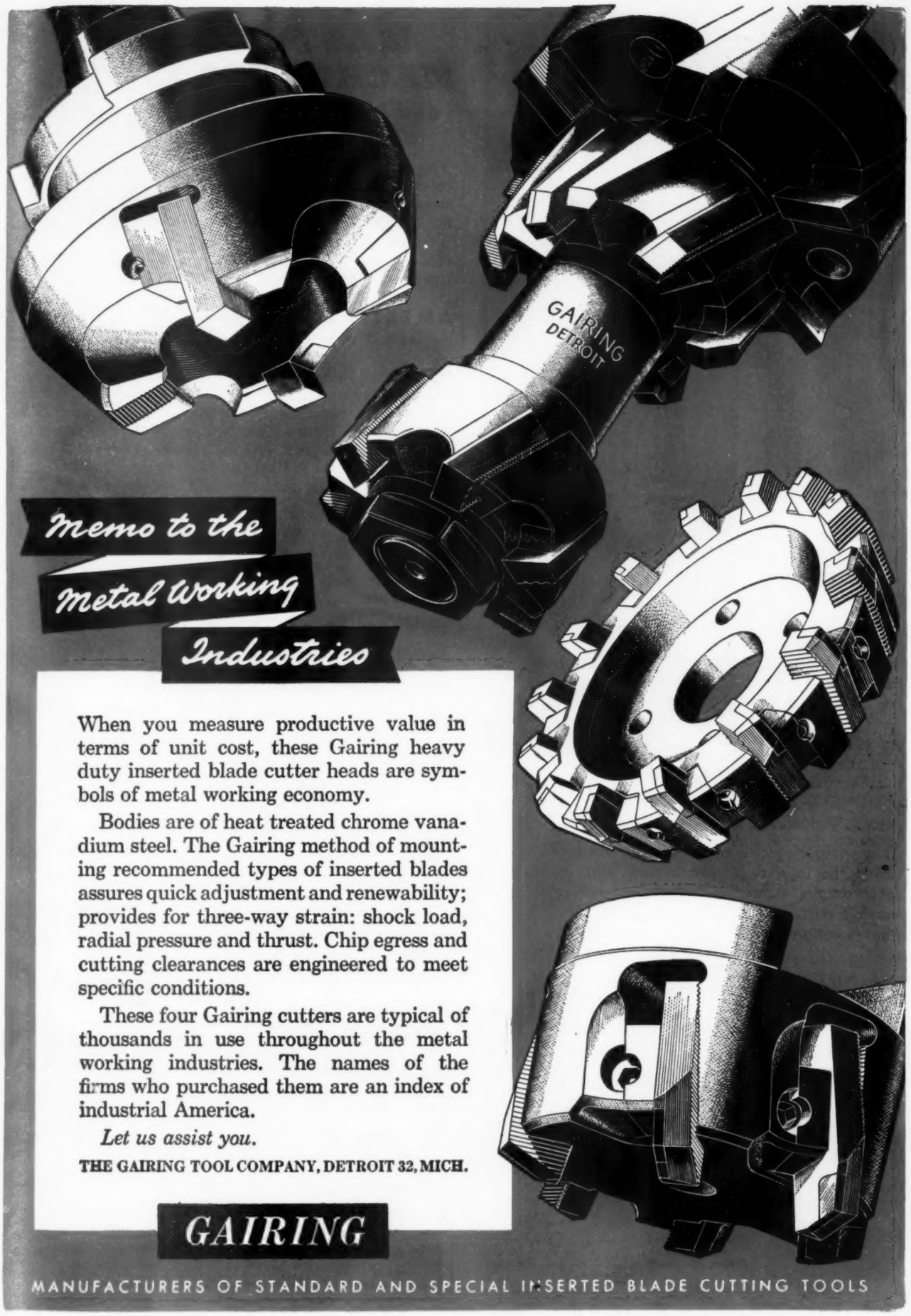


Memo to the Metal Working Industries

When you measure productive value in terms of unit cost, these Gairing heavy duty inserted blade cutter heads are symbols of metal working economy.

Bodies are of heat treated chrome vanadium steel. The Gairing method of mounting recommended types of inserted blades assures quick adjustment and renewability; provides for three-way strain: shock load, radial pressure and thrust. Chip egress and cutting clearances are engineered to meet specific conditions.

These four Gairing cutters are typical of thousands in use throughout the metal working industries. The names of the firms who purchased them are an index of industrial America.

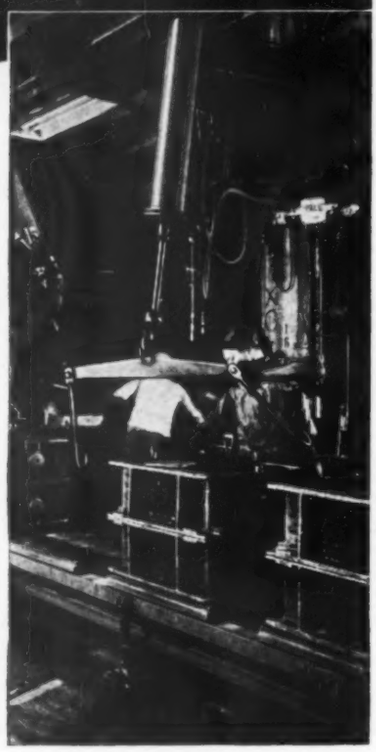
Let us assist you.

THE GAIRING TOOL COMPANY, DETROIT 32, MICH.

GAIRING

MANUFACTURERS OF STANDARD AND SPECIAL INSERTED BLADE CUTTING TOOLS

FOUNDRY *Speeds Production* ROUTINE WITH **CURTIS AIR CYLINDERS**



Here's another example of how Curtis Air Cylinders speed up production, make material handling easier, and save manpower for other jobs. Curtis Air Cylinders in this large foundry quickly, easily, and accurately handle heavy molds.

Curtis Air Cylinders and Air Powered Hoists are engineered to meet your individual requirements — designed to handle practically any lifting, pulling, or pushing operations — they are saving time, labor, and cutting costs in hundreds of industries today.

They provide exceptionally accurate control of loads, cannot be injured by overloading, and because of their simple, rugged construction, with only one moving part, they'll stand up under the heaviest kind of continuous service.

It will pay you to send for Bulletin A-4-B, which gives full information.

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1924 Kienlen Avenue, St. Louis 20, Missouri
Established 1854

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THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations—show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

Puts the mastery of machine-shop work at your fingertips

With these books at hand for quick reference, no job is too hard or unusual, and the routine jobs may be improved, with savings in time and trouble and reduced wastage.

What the Library gives you

—complete guide for everybody, from shop executive to apprentices, interested in the operation of machines used in turning and boring practice
—description of all important varieties of machines, both manual and automatic, and methods of operating them
—data on speeds and feeds, new cutting alloys and materials, use of coolants, etc.
—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work
—training in the various operations performed in drilling and surfacing materials in the machine shop
—exact, descriptive data on all aspects of gear-cutting practice, useful in shops of any size
—essentials of selecting machines, setting up work, and handling operations in reaming, tapping, planing, shaping, slotting, milling and broaching.

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Send me the American Machinists' Library, 6 volumes, charges prepaid, for 10 days' Examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until the special price of $19.50 has been paid. Otherwise I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

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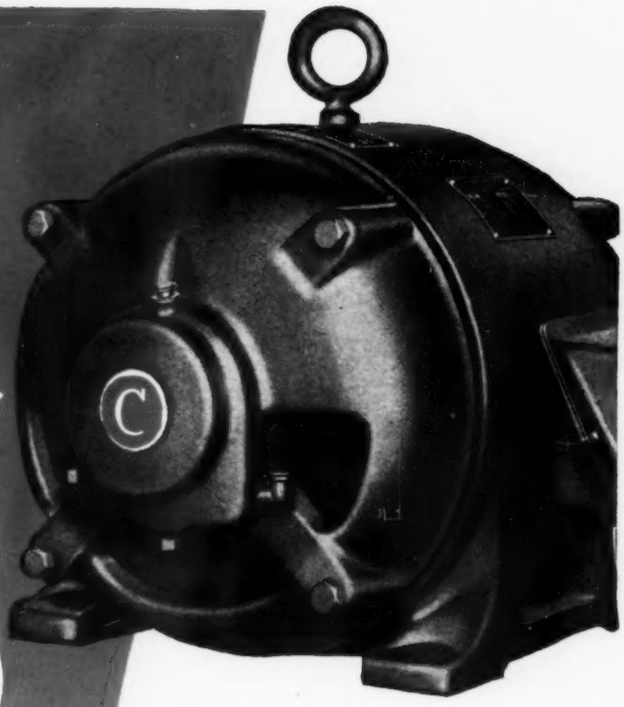
CENTURY Form J Squirrel Cage MOTORS Have the *Durability* to Match the Ruggedness of the Machines They Drive



Century 10 horsepower Form J Squirrel Cage Motor driving a vertical miller. Notice that the top half of the motor is enclosed to protect against falling solids and dripping liquids.

As shown in the illustration, electric motors are often located out-of-sight—and may be forgotten by the user. That's why Century Form J Motors are made to take punishment, yet give dependable power at the push of a starter button.

Rugged frames and accurately machined feet for solid mounting contribute to the durability of Century Form J Motors. Yet, they start and run quietly and with unusual freedom from vibration. These features contribute to greater accuracy on such applications as machine tools and processing equipment.

Specify Century Motors on all your electrically powered equipment. Engineered to the functional characteristics of the machines they drive to assure top performance—Century Motors are a vital factor in producing a better product at a lower cost.

Century Motors are built in sizes 1/20 to 600 horsepower.

CENTURY ELECTRIC CO.
1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS

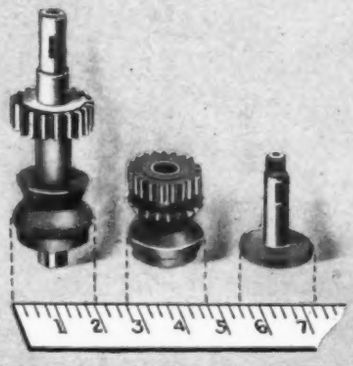
CE-443

They Increased Profit

WITH X1515 AND X1545

SPEED CASE SPEED TREAT

STEELS



American Screw Machine Products Inc.

MANUFACTURERS OF SCREW MACHINE PRODUCTS and PLANER & STICKER BOLTS CAPACITY FROM ¼ INCH TO 6 INCHES HAND OR AUTOMATIC

4643-4657 WEST HURON STREET • CHICAGO 44, ILLINOIS • PHONES AUSTIN 1637-38-39

November 19, 1945

Monarch Steel Company
543 W. McCarty Street
Indianapolis, Indiana

Att: S.W. Terry

Gentlemen:

We manufacture many different shaped rolls for a metal sheet bending machine.

Many months ago our customer standardized on Speed Case X1515 Steel for these rollers after considerable experimenting with such steels as C1117 and C1019.

They found that the surface finish of the completed rolls made from SPEED CASE X1515 was very smooth and practically faultless which was a great improvement over either C1117 or C1019. The matter of finish of the rolls is of prime importance when form rolling sheet metal in order to avoid indentations being made in the finished product.

Our customer also finds greatly improved results in carburizing SPEED CASE X1515 as compared to C1117 or C1019 and reports longer wear on the Speed Case Rolls, resulting in fewer replacements by the users of the machines.

Both machinability and tool life was increased from 20 to 22% through the use of SPEED CASE X1515, and the gear hobbing is cleaner with a much superior finish.

We know we have been able to reduce our costs, increase our production and still give our customer a much finer product through the use of SPEED CASE X1515 Steel.

Assuring you of our pleasure in giving you the above information, we are

Yours truly,
American Screw Machine Products
By Wm Perry Hoffman

wrh/vh

THEY SAY THIS . . .

Free Machining with Lengthened Tool Life
Excellent Carburizing
Exceptional Finish
Reduced Replacements
INCREASED PROFIT

See Demonstration of Machinability, Strength and Ductility of these Steels

Booth P-526 in Arcade
NATIONAL METALS EXPOSITION
Cleveland, Ohio • February 4th through 8th

Write for SPEED CASE and SPEED TREAT CATALOG
Our Metallurgists are at your service

Licensee for Eastern States

THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

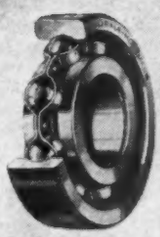
Licensor

MONARCH STEEL COMPANY
HAMMOND • INDIANAPOLIS • CHICAGO

PECKOVER'S LTD., Toronto, Canadian Distributor

PRECISION BEARINGS

Separable (Magneto) Ball Bearing



Single Row Ball Bearing

FOR EVERY LOAD, SPEED AND DUTY

108 DISTINCT SERIES

BALL, ROLLER AND THRUST

OVER 3000 SIZES

1/8" to 22 1/2" Bore—Metric and Inch Sizes

Write for the Catalog and Engineering Counsel

NORMA-HOFFMANN BEARINGS CORP'N. – STAMFORD, CONN., U. S. A.

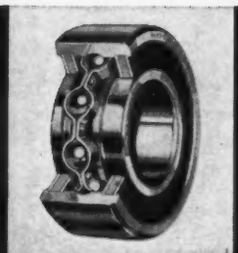
"NORMA-HOFFMANN"

Litro ("CL") Composition Retainer Ball Bearing

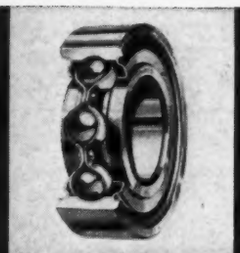
Double Row Self-Aligning Ball Bearing

Shielded Type Single Row Ball Bearing

Single Felt Seal Ball Bearing



Double Felt Seal Ball Bearing

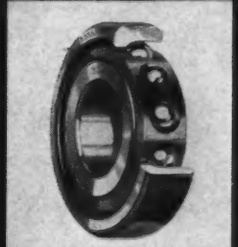


9000 Series (Feltless) Sealed Ball Bearing

"Cartridge" Fully Sealed, Refillable Type Ball Bearing

Double Row Ball Bearing

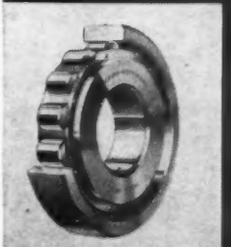
Extra Light Type Ball Bearing



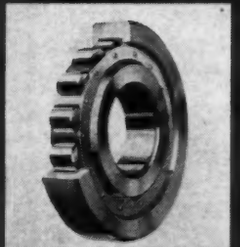
Angular Contact Ball Bearing

Extra Light Single Direction Ball Thrust Bearing

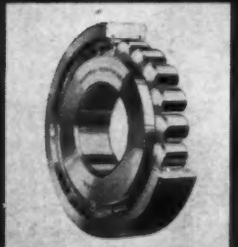
Single Direction Ball Thrust Bearing



Standard Cylindrical Roller Bearing



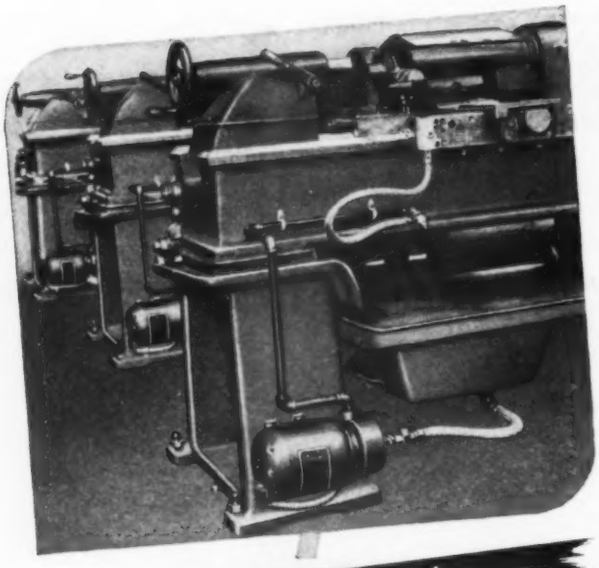
Type "E" Cylindrical Roller Bearing



Full Type (Retainerless) Cylindrical Roller Bearing

Extra Light Cylindrical Roller Bearing

Two-Lipped Cylindrical Roller Bearing



Legions of Lathes

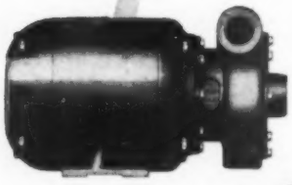
depend upon

Pioneer Pumps

● Built to exacting standards, Pioneer Pumps are worthy adjuncts to the finest lathes —aids to closer tolerances, better finishes, longer tool life.

Especially designed for limited space installations, the Model "H" may be mounted either vertically or horizontally at the exact spot where its efficiency is highest, even though the position is some distance from the reservoir.

Seventeen variations of the Model "H" are included in the 400 standard Pioneer Models which aid modern machine tools so effectively.



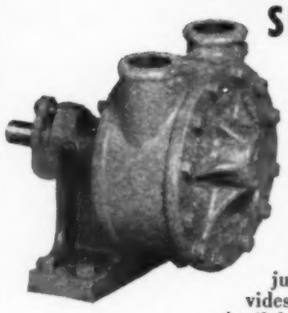
Reed-Prentice Lathe battery, above, receives unfailing coolant stream from Pioneer Model "H" Pumps.

PIONEER Pumps
SEAL TYPE, SEAL-LESS AND ROLLWAY
FOR PUMPING COOLANTS · CUTTING FLUIDS
ABRASIVE LIQUIDS · LUBRICANTS · WATER

Pioneer Pump & Manufacturing Co.
19651 JOHN R ST. • DETROIT 3, MICHIGAN

TUTHILL MEANS DEPENDABLE PUMPS

FOR COOLANT SERVICE SPECIFY MODEL M



For years a stand-by in coolant service. Tuthill Model M provides a precision-built pump with special features that assure trouble-free performance. Self-priming. Positive delivery. A built-in automatic by-pass protects the pump against excessive pressure and allows small particles to pass through without serious injury to working parts. Model M provides capacities from 1 to 50 g.p.m. Available in stripped form for direct incorporation into the design of the machine. Write for Model M bulletin.

TUTHILL

TUTHILL PUMP COMPANY • 939 E. 95th ST. • CHICAGO 19, ILL.

Tubular MICROMETER

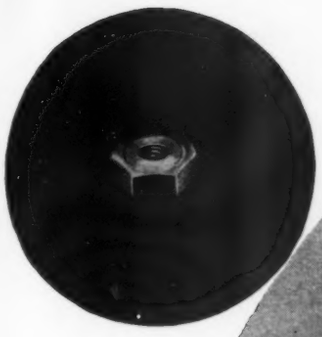
FEATHER TOUCH

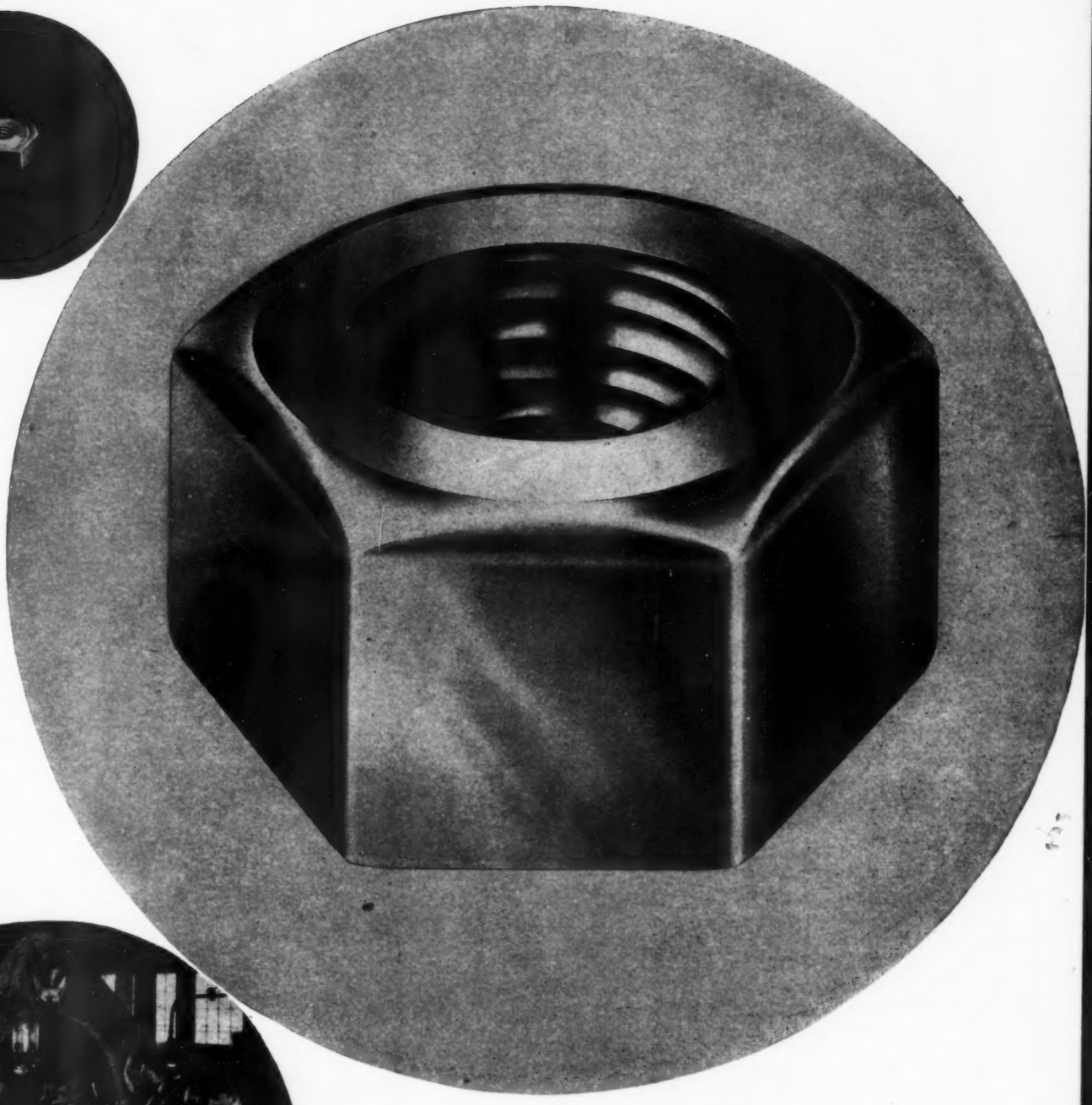
LIGHTER-STRONGER MORE ACCURATE

TU-MI-CO TUBULAR construction of special homogeneous grain structure steel is 25 to 50% lighter than solid frame, yet highly shock resistant. Triple plated—copper, nickel and chrome More sensitive feel, easier to use. Low thermal conductivity—combats "walk" in measurement. Tool steel spindle with threads *ground* for accuracy. Adjustment in bushing to maintain alignment Get TU-MI-CO precision. Prompt delivery

89 SIZES AND TYPES

TUBULAR MICROMETER CO.
ST. JAMES, MINNESOTA, U. S. A.





WHERE PERFORMANCE HANGS BY A THREAD

The smallest Circle Ⓑ fastener plays as important a part in the dependable operation of any machine or vehicle as does a giant casting. That's what our inspectors think of when they check the threads of a Buffalo bolt or nut for strength and accuracy.

◀ One of the modern nutmaking machines designed and built by the Buffalo Bolt Co.

Ⓑ BUFFALO BOLT COMPANY

NORTH TONAWANDA, NEW YORK

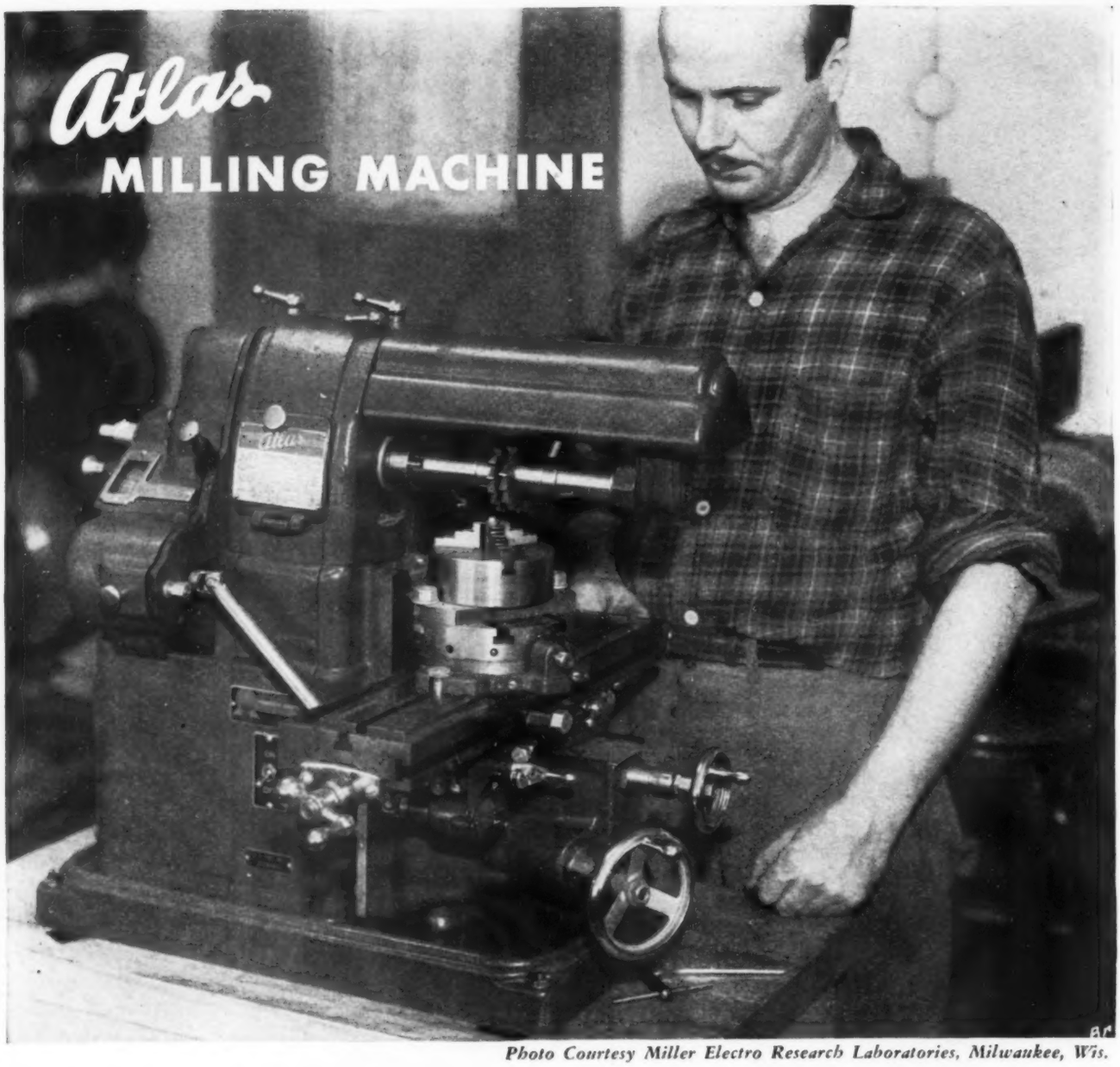


Photo Courtesy Miller Electro Research Laboratories, Milwaukee, Wis.

QUICKER, MORE EFFICIENT on Small Parts Operations

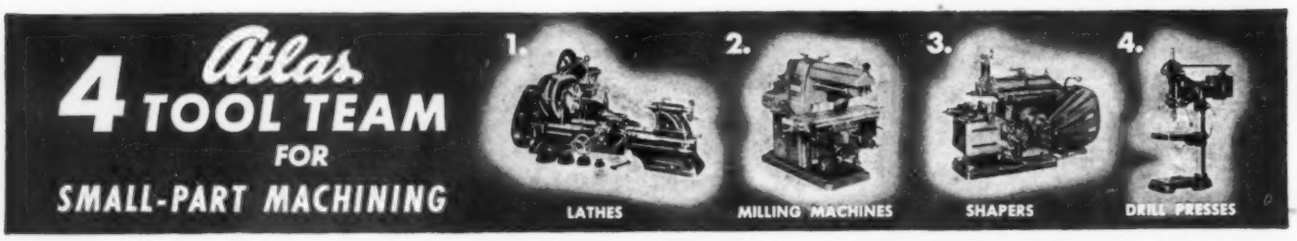
YOU CAN save a lot of set-up time and effort — in the tool room or on the production line — with this compact Atlas milling machine.

Any part that comes within its 4½" x 18" table traveling 10" longitudinally and 3½" cross-table, can be milled to close tolerances quickly and easily. There are eight spindle speeds from 62 to 2870 RPM. Three types of table controls are available — manual, lever, or Change-O-Matic. Adding air chuck and control devices gives you a semi-automatic machine capable of suprising production records.

The Atlas milling machine, like the rest of the Atlas 4 Tool Team, helps you "match the machine to the job" to lower machine-hour costs and eliminate wasting the capacities of large machines. Send for latest catalog.

ATLAS PRESS COMPANY, 104 N. Pitcher St., Kalamazoo 13D, Michigan.

Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH.
U.S.A.



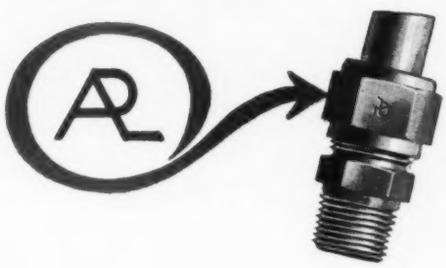
Select

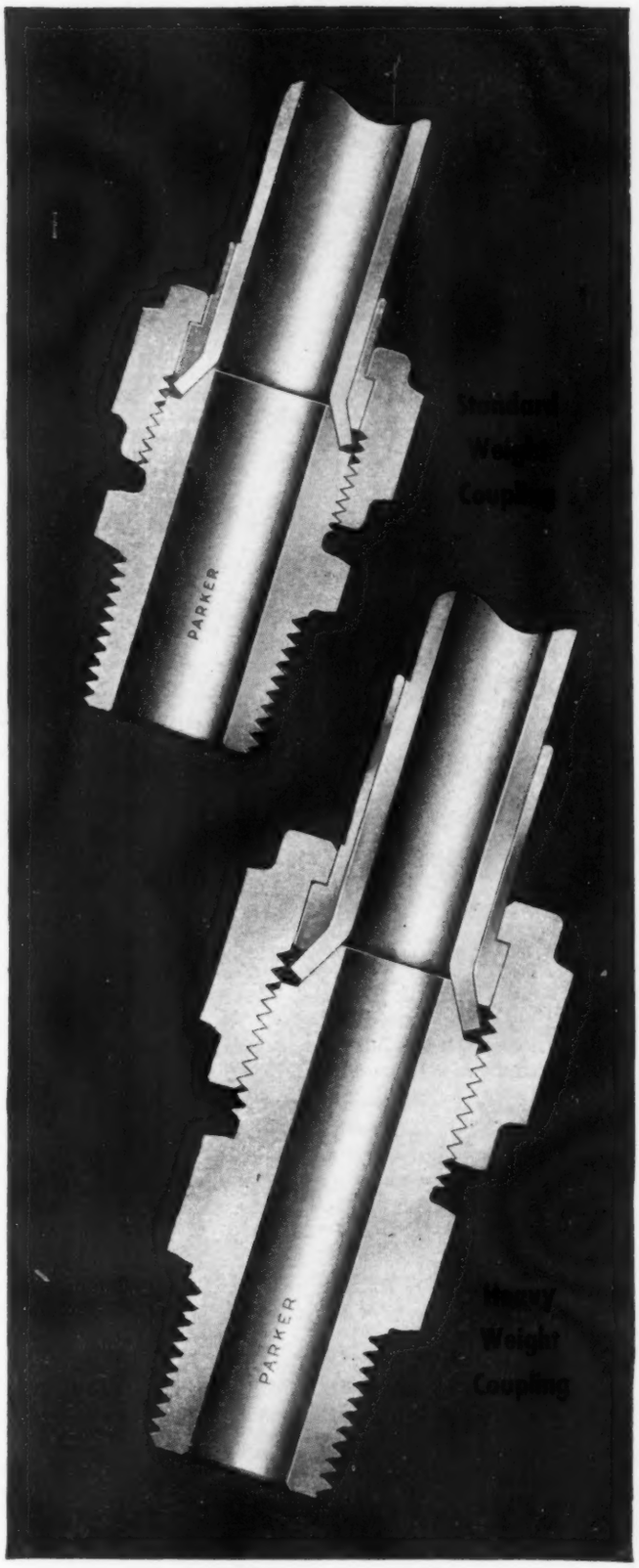
THE TUBING THAT FITS THE JOB AND

THE COUPLING THAT FITS THE TUBING

That's sound engineering—sound Fluid Power engineering. It means a tubing system that insures smooth, streamlined flow, with leak-tight and vibration—proof joints, plus easy installation and maintenance.

The Parker trade mark is your assurance of getting exclusive and patented Parker design features that set the standard for Army-Navy aircraft and ordnance use.



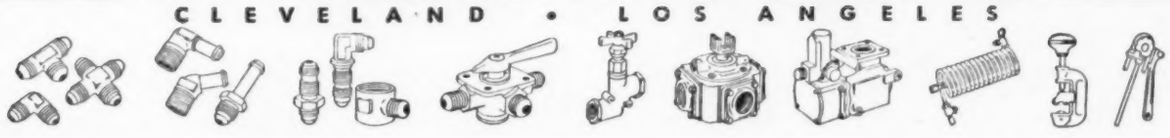


Note particularly the angle of the flare. It is scientifically set to provide maximum clamping surface, with equalized pressure all around. All stress and strain are taken on the body, nut and sleeve—there is full protection for the system against shock and vibration.

Catalog 201-C gives complete data on *standard weight* and *heavyweight* triple couplings —$\frac{1}{8}$" to 1$\frac{1}{2}$"—in steel, brass, stainless steel and aluminum. Ask your jobber or write to The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES

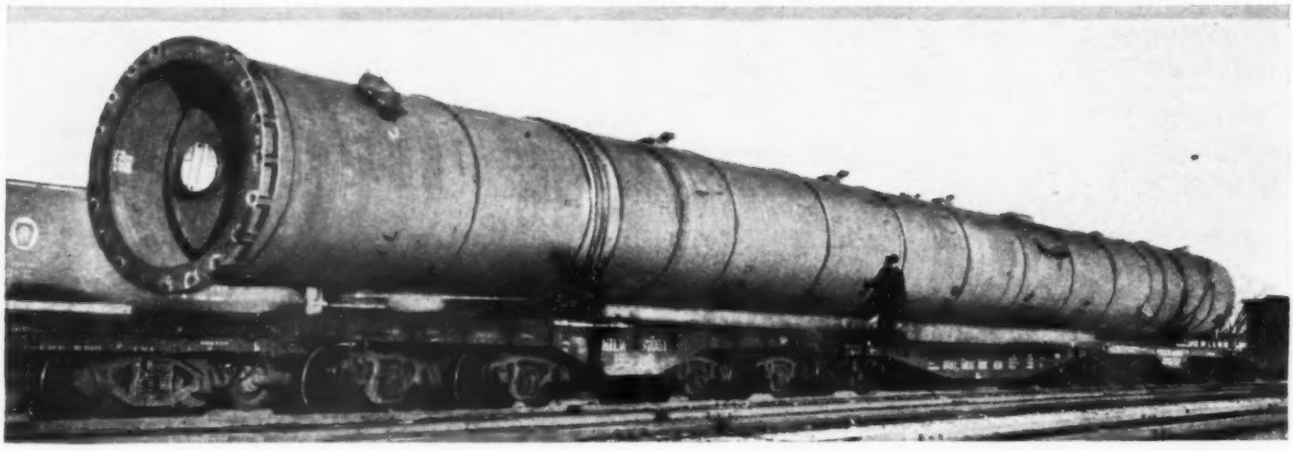


FLUID POWER PRODUCTS FOR ALL INDUSTRY

1925

The first SMITHway pressure vessel established an electric arc-welded construction that overcame the most serious industrial hazards ever known in the petroleum industry.

In 1925, *the First* . . . In 1946, *the Largest*



1946

Twenty-one more years of unending welding research, makes possible today this single-piece 160-foot 446,000-lb. deisobutanizing tower; a SMITHway vessel which produces 652,000 gallons per day of butane.

ACTUAL shop production has proved SMITHway Certified Welding Electrodes from the day they were first developed. A. O. Smith plants use more than 320,000 a day; millions more are used by other manufacturers.

This wealth of production and application experience has been paralleled by continuous welding research in A. O. Smith laboratories. Each year since 1917 has seen the development of improved SMITHway Electrodes. Each year has seen these electrodes employed by A. O. Smith to pioneer the welding of every type of steel product . . . small, simple products no less than structures weighing up to half a million pounds.

For detailed specifications of SMITHway Certified Electrodes and their application to specific welding jobs, send for the SMITHway Welding Guide.

Mild Steel . . . High Tensile . . . Stainless Steel

WELDING ELECTRODES

made by welders . . . for welders

SMITHway A.C. Welders

Six models, including three new models of 150-, 200-, and 250-ampere capacity. Heavy Duty Models of 300-, 400-, and 500-ampere capacity. Write for complete specifications and prices.

SMITHway Certified WELDING ELECTRODES

A. O. SMITH Corporation

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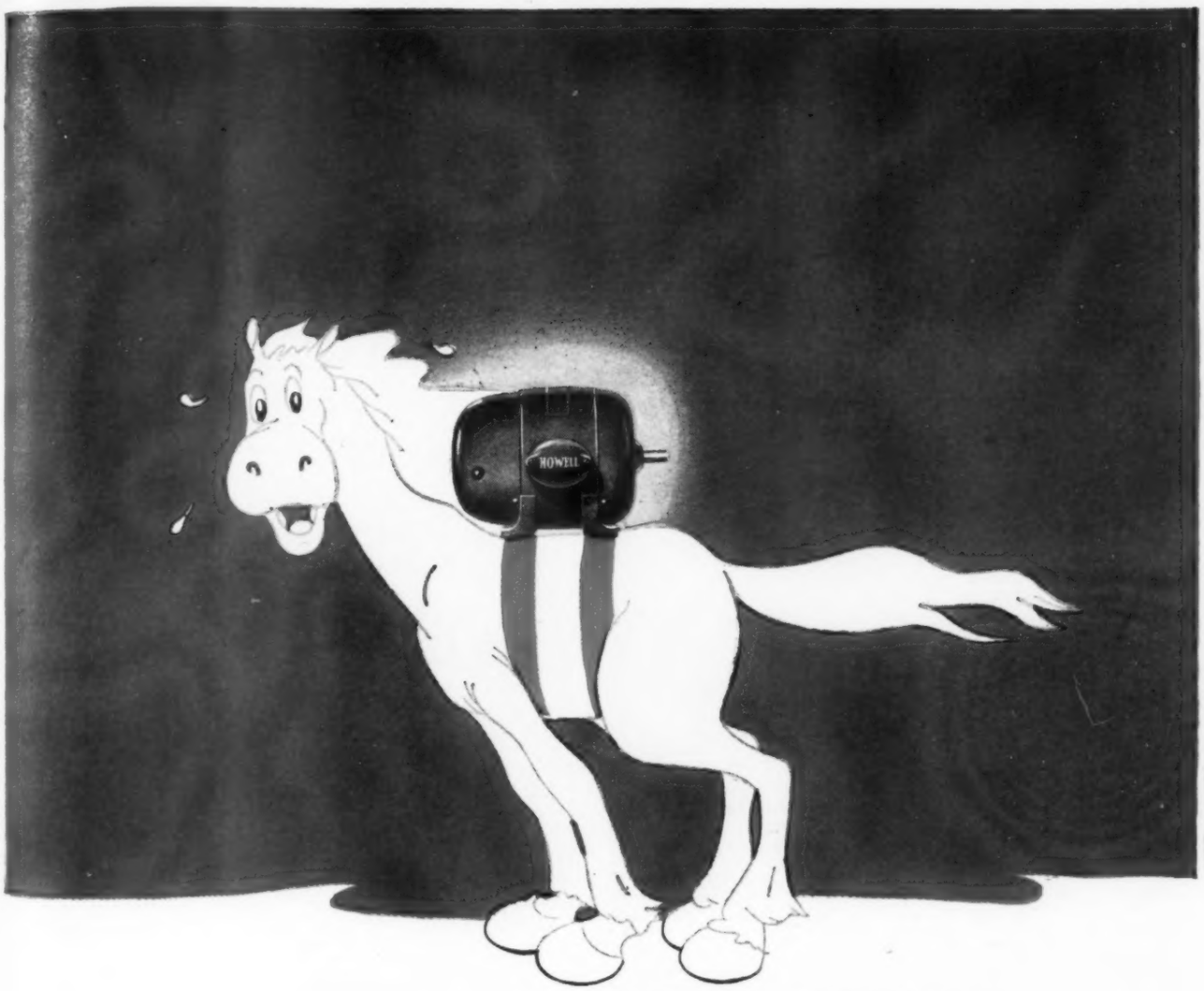


HERE'S WHY I'M RED BANDED!

The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available. *Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.*

Years ago—1915 to be exact—we set out to build a line of motors to do specific jobs in industry.

These jobs were all what you would call "tough jobs." They were gruelling tasks which required the precision-building of higher-quality motors. They were jobs which demanded thorough insulation and sturdy construction.

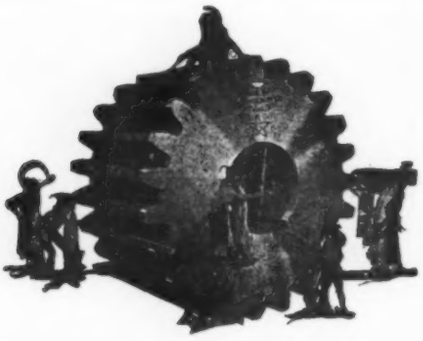
We built our motors to meet the rigid requirements of just such jobs as these. To distinguish them from other makes, we put Red Bands on them. We constantly challenged buyers to give "Red Band" Motors their tough jobs.

They did! Performance alone brought bigger and bigger sales volume. Each year, more and more industries, like yours, learned to depend on Howell quality.

Today, modern construction of our motors does not make it practical to include the Red Bands, but their quality is the same or better than that of the motors that bore the famous Red Band.

To remind you that we are continuing our high quality construction and that we are zealously guarding our reputation we have put the Red Bands on the friendly Howell Horse.

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Manufacturers of Quality Motors Since 1915



GANSCHOW

CUT GEARS — ALL TYPES

MEMBER OF AGMA

Better Gear Products

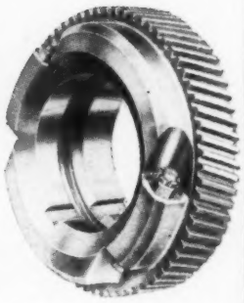
GANSCHOW GEAR CO., 14 N. Morgan Street, CHICAGO 7.

Gears

GEARS, GEARS, GEARS. Small ones or large • Stahl Gear has only one standard of quality • the best. We invite you to talk over your "big" gear problems with us. Many users could testify that Stahl is "geared" to serve you well. *TRY US.*

THE STAHL GEAR AND MACHINE CO.
3901 HAMILTON AVENUE CLEVELAND, OHIO
SPURS, SPIRALS, BEVELS, RACKS, WORMS • ANY SIZE • ANY QUANTITY

FOR THOSE TOUGH JOBS...



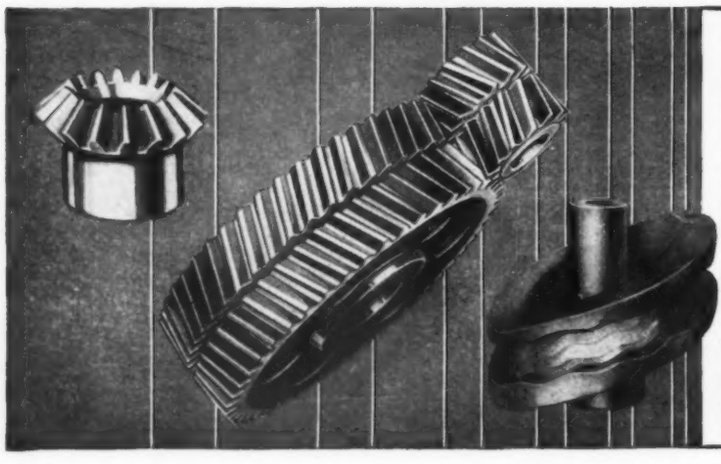
How hard a machine can work, and how long, rests largely with its gears. Demands are great, and the job must go on . . . day in and day out.

It's here that Cincinnati *Gears, Good Gears Only,* prove their value. Both in peace and war they have maintained outstanding records of performance.

Over forty years of quality with precision in serving industrial requirements have proven the wide acceptance of Cincinnati *Gears, Good Gears Only,* for the tough jobs!

- SPUR
- BEVEL
- HELICAL
- SPLINE
- WORM
- SPECIAL

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio



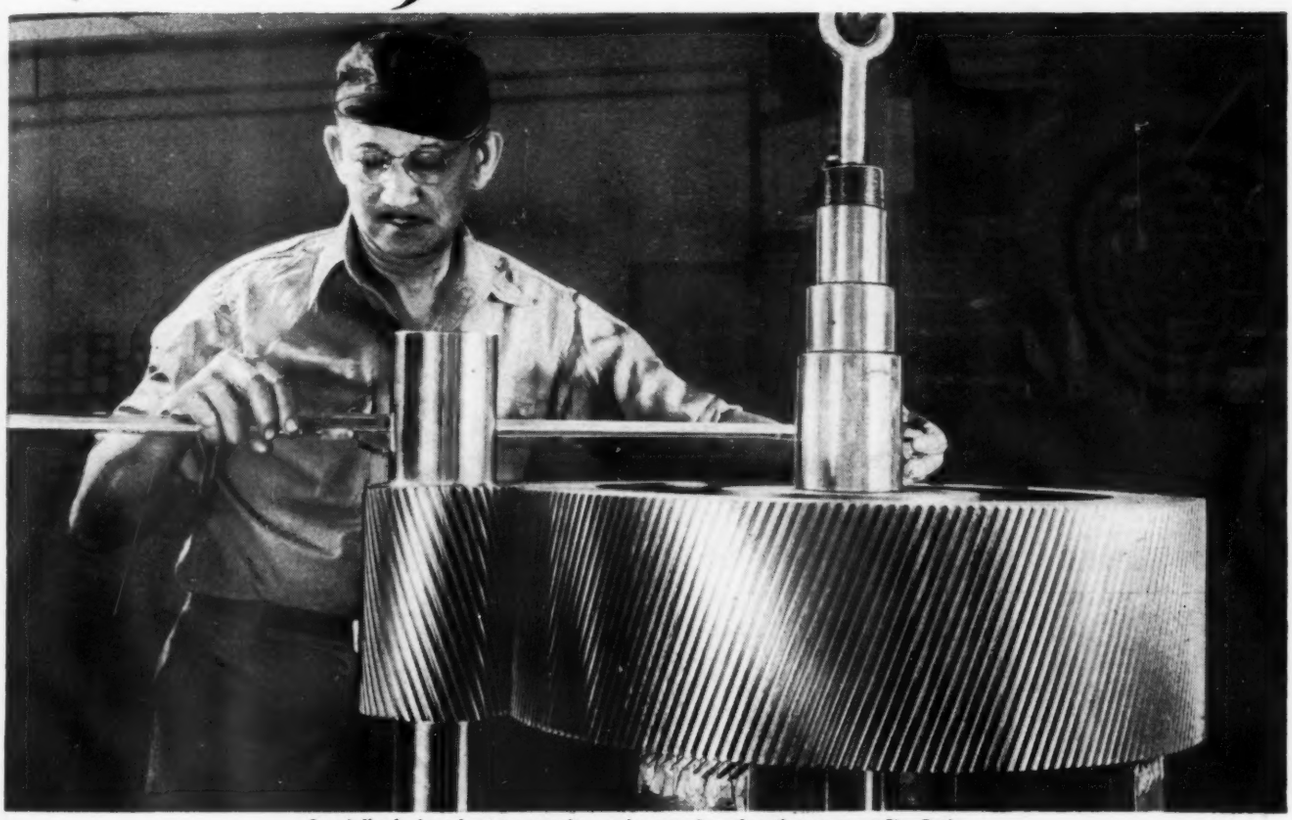
GET YOUR QUOTATION *from* "HARTFORD"

GEARS of every description cut to order
GEAR; CAM and THREAD grinding
AERONAUTICAL PARTS on contract basis

Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.

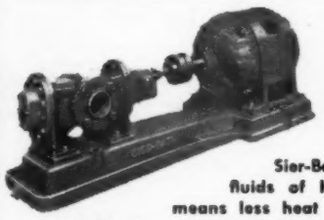
THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD CONNECTICUT

QUALITY
QUANTITY
DELIVERY
GET ALL THREE from SIER-BATH



Specially designed set-up permits precise gauging of mating gears at Sier-Bath.

● Which is your most pressing need—quality, quantity or delivery? Or must you have all three? You can get them all at Sier-Bath. For here, time is regarded as important as precision. Modern equipment including gear shavers make possible Sier-Bath's high dimensional uniformity on long, fast runs. Automatically controlled furnaces and hardeners prevent distortion. It is a combination of old time craftsmanship and modern machinery. A sample order will show what we can do.



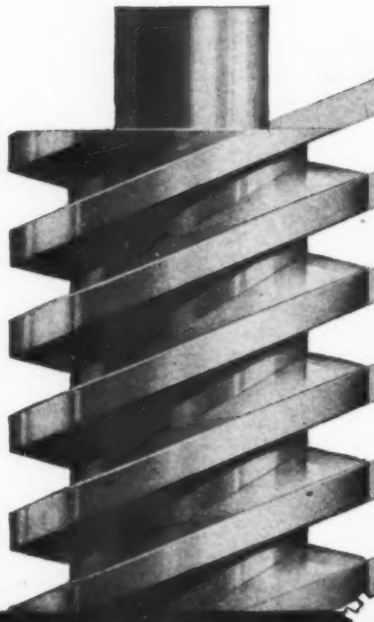
REDUCE COLD WEATHER PUMPING COSTS

Sier-Bath Screw Pumps handle fluids of higher viscosity and that means less heat is needed to make thick fluids flow through these pumps in winter. Write for bulletin today.

SIER-BATH GEAR COMPANY

9246 HUDSON BOULEVARD NORTH BERGEN, N. J.

THE ART OF ACCURACY



QUAKER CITY CRAFTSMEN, USING THE MOST MODERN MACHINES PRODUCE PRECISION GROUND FORM WORMS . . . OUR RIGID STANDARDS ARE NOW MEETING EXACTING DEMANDS OF THE ELECTRONICS INDUSTRY . . . YOUR INQUIRY WILL BE APPRECIATED AND WILL BE GIVEN PROMPT ATTENTION.

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PHILADELPHIA 22, PENNA.

QUAKER CITY GEAR WORKS, INC.

Experts IN THE MANUFACTURE OF

ZEROL GEARS

WE RECOMMEND ZEROL GEARS FOR SMOOTHER QUIETER OPERATION WHEN STRAIGHT BEVEL GEARS ARE CONVENTIONALLY USED

GEARS OF ALL TYPES and MATERIAL—UP TO 36"
MADE *Exactly* TO YOUR SPECIFICATIONS

DETROIT *Bevel Gear* COMPANY
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BEVEL GEAR RATIO
can be changed by merely changing the pinion.

BILGRAM GEAR & MACHINE WORKS
1217-35 Spring Garden, Philadelphia, Pa.

GEARS TO ORDER

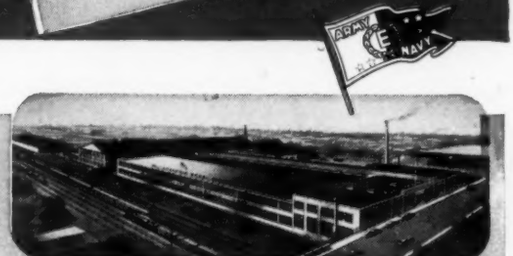
Spiral and helical gears; special couplings, bushings and collars; pins, pulleys and rollers. Made to your specifications—*promptly*.

KELLEY GEAR & TOOL CO.
Bristol, Tennessee

One Name-ALL TYPES

In fact, Phillie Gear was one of the true Pioneers in the design and manufacture of *Speed Reducers, for Industrial Purposes.*

For every conceivable type of Industrial Drive, there is a correct type of Philadelphia Speed Reducer—and by choosing Philadelphia Reducers, you not only secure *Quality Products,* but you place the responsibility for their construction and operation with *one manufacturer* (a point worthy of serious consideration).



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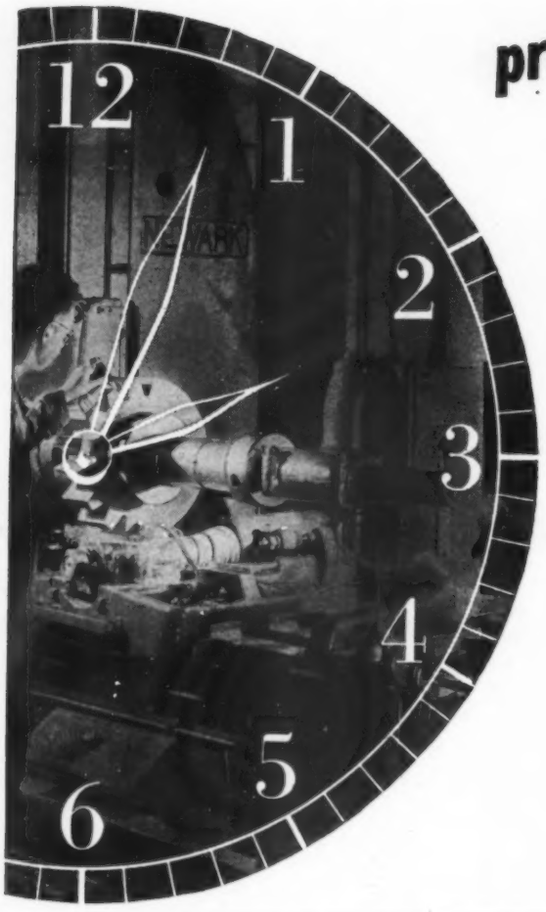

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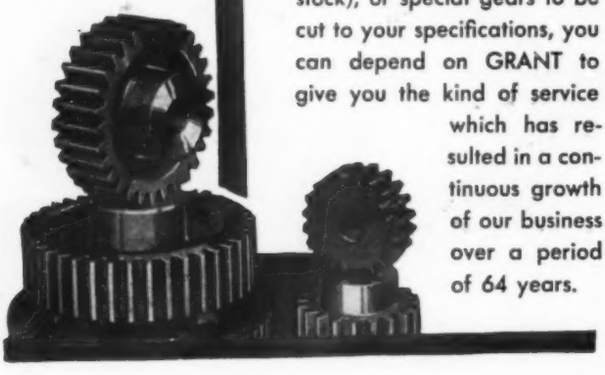

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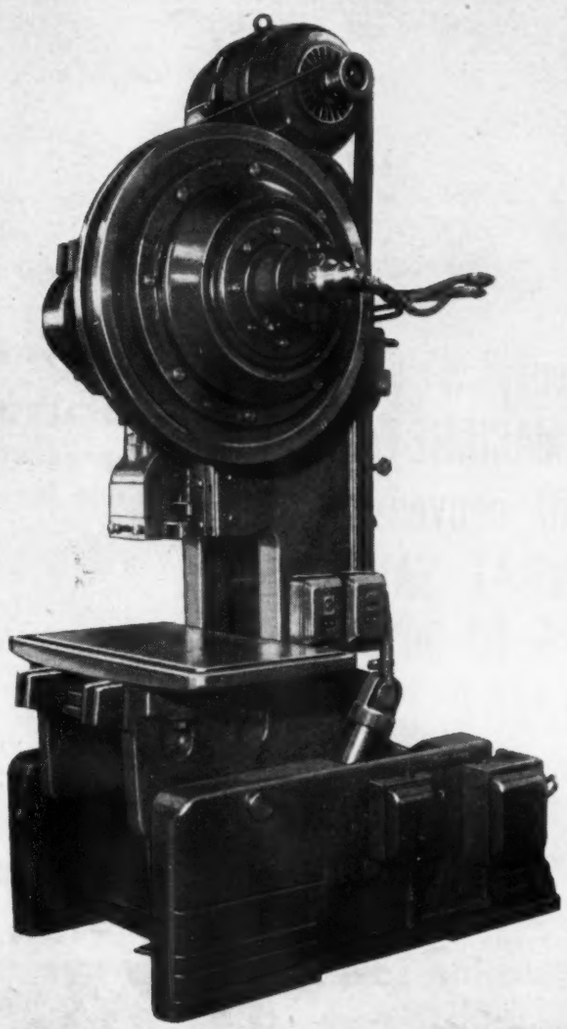

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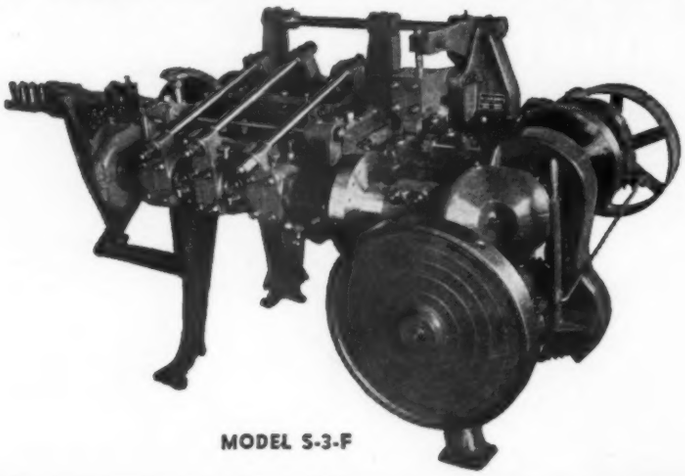

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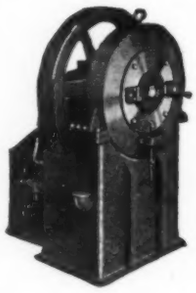

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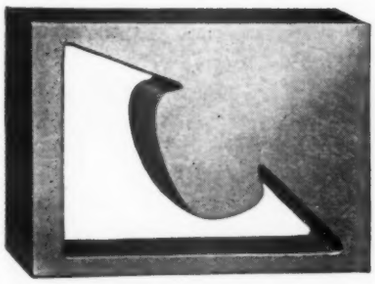

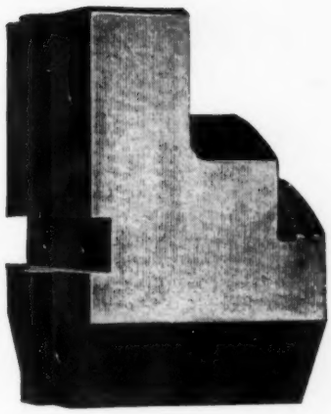

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TYPICAL ANALYSIS:

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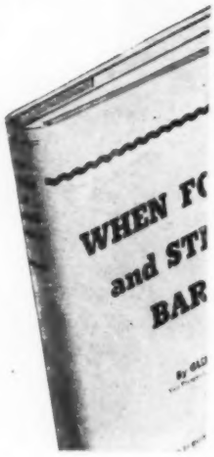
It is the first book to bring the foreman practical methods aimed directly, plainly and simply at the critical and important area of his daily bargaining with the steward—



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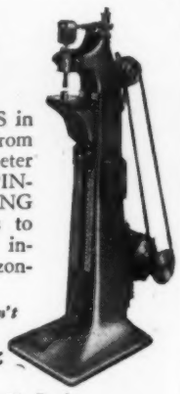

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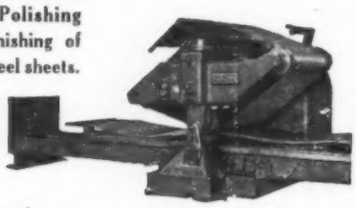
Mattison W-455 Wide Belt Grinding and Polishing Machine for finishing of wide stainless steel sheets.



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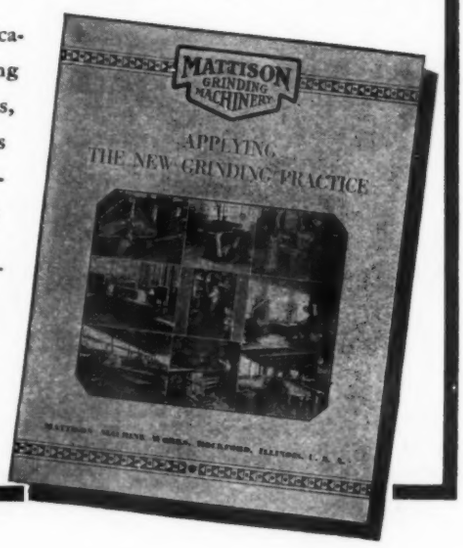

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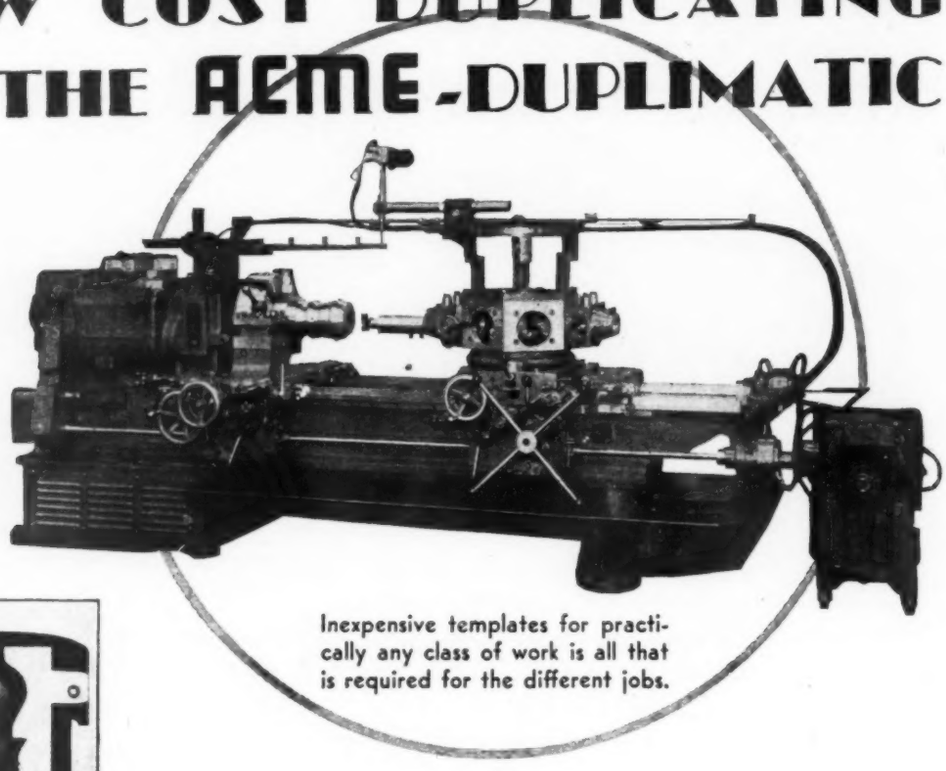
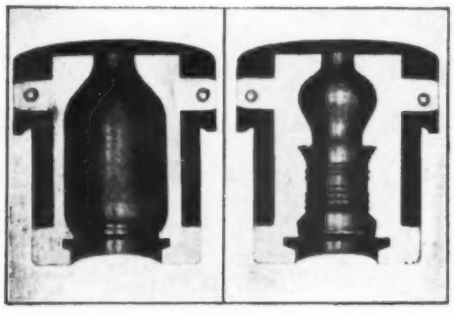
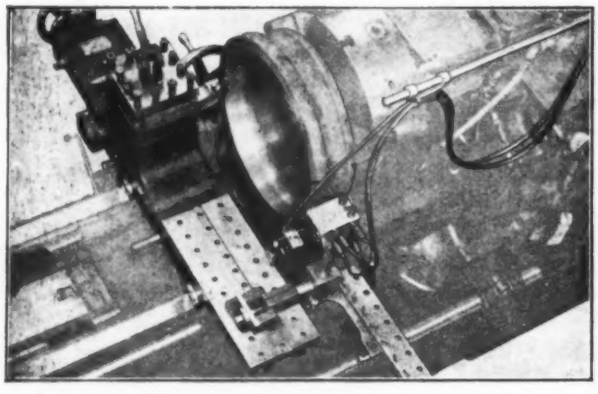


Inexpensive templates for practically any class of work is all that is required for the different jobs.





A new development in low cost contour turning and boring for Plastic, Glass and Rubber Molds; all types of Dies. No shapes too difficult.

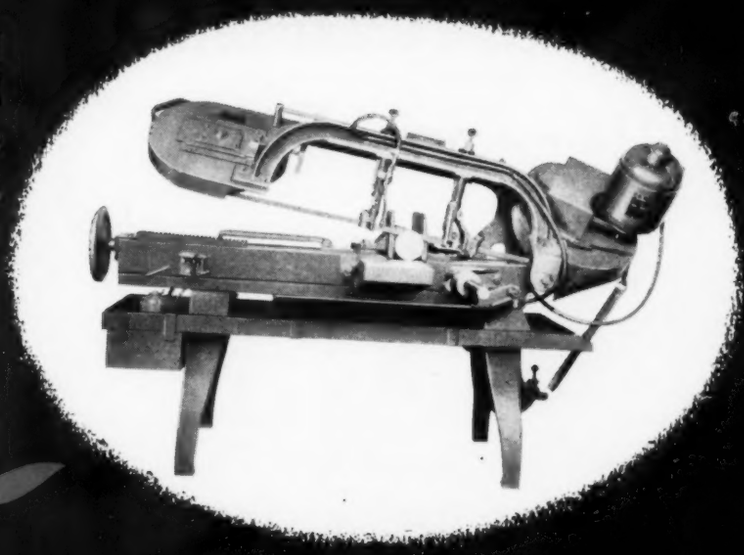
Through the means of a push button station, the duplicating equipment can be disengaged, and the machine is then ready for standard turret lathe work.

If you are interested in lowering the cost on your present methods for this type production — we can help you. It's a subject for our engineers — so — send us your problems. No obligation—of course.

The ACME MACHINE TOOL Co.
CINCINNATI 32, OHIO

SPOTLIGHT ON UTILITY

. . . . year in and year out . . . you'll be glad you have this handy tool . . .



WELLS *No. 8*
METAL CUTTING BAND SAW

Above photo shows a Wells No. 8 equipped with the new Wells Wet Cutting System—an economical accessory

SET a Wells No. 8 on the floor in your shop, and from that day on, you have at your service one of the most useful cutting tools available. It cuts bar stock, angles, square or round tubing—all types of metals and every size that can be fitted into it.

Use your Wells in the storeroom, tool room or for maintenance work. Move it to the job quickly and easily to save time and labor. Equip it with the new Wells Wet Cutting System for production work too.

Anybody can operate an easy-to-use Wells. In fact, the gravity-feed and automatic shut-off make it possible for one man to operate two or more Wells saws at the same time.

Thousands of Wells No. 8's are in use today . . . ample proof of their utility and worth. Where can *you* use one?

Specifications

CAPACITY: Rectangular	8" x 16"
(Special Guides)	5" x 24"
ROUNDS:	8" Diameter
MOTOR:	½ H.P., A.C. or D.C.
SPEEDS:	Selective 60, 90, 130 feet per minute
WEIGHT:	Approximately 665 pounds

Wells SAWS

Wells

Products by Wells are Practical

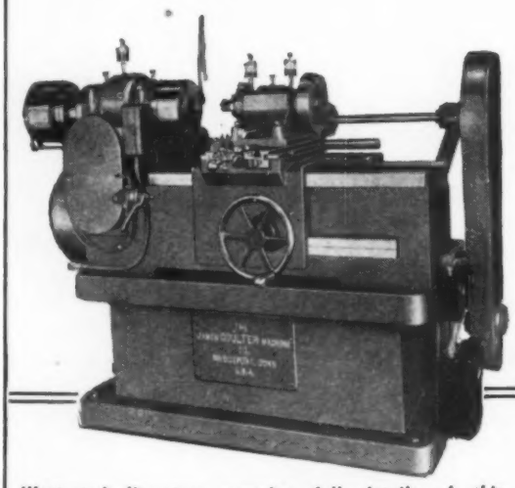
METAL CUTTING BAND SAWS

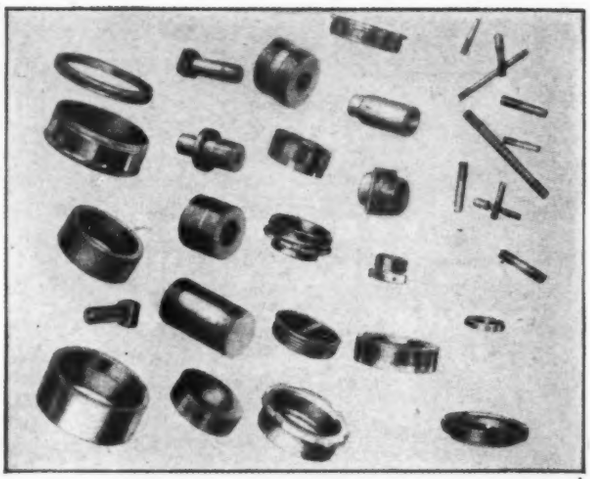
WELLS MANUFACTURING CORPORATION
505 ROOSEVELT ROAD, THREE RIVERS, MICHIGAN

. . . for Precision Internal or External Threads . . . Right or Left Hand

HANDLE PRODUCTION AUTOMATICALLY on the

COULTER HOB THREAD MILLER





This modern machine can be depended on to produce and duplicate close tolerance threaded parts. With the exception of loading, all operations are fully automatic. Any parts that can be held in a Universal chuck, air-operated chuck or special fixture can be threaded, on the COULTER, internally or externally, either right or left hand.

Work can be inserted from either face or rear end, through large hole in work spindle, thereby making possible the threading of shaft ends, tubing or other long work.

Individual Motors on the COULTER for work and cutter spindles provide a wide range of speeds and feeds for handling such materials as brass, aluminum or steel.

Illustrated literature covering full details of this machine is available promptly on request.

THE JAMES COULTER MACHINE CO.

BRIDGEPORT, CONNECTICUT

MOREY *Universal* TURRET LATHES *for* BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

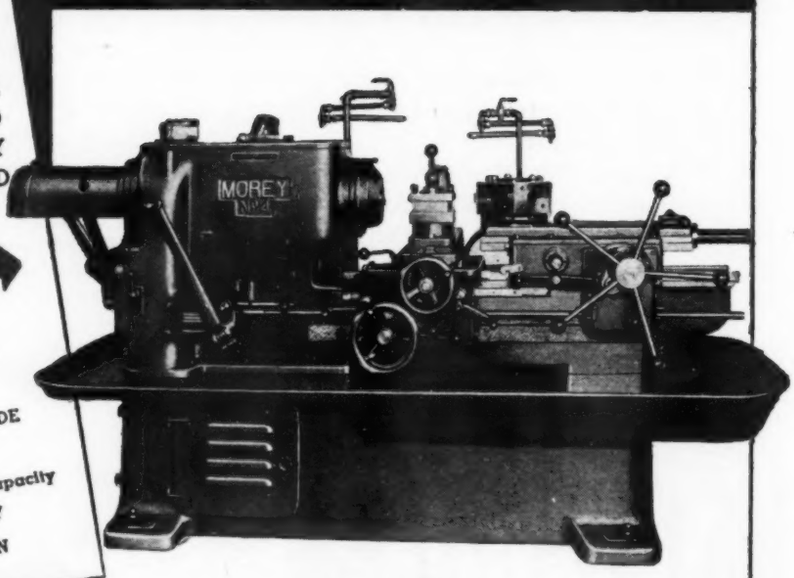
EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
No. 2 Plain, 1" capacity

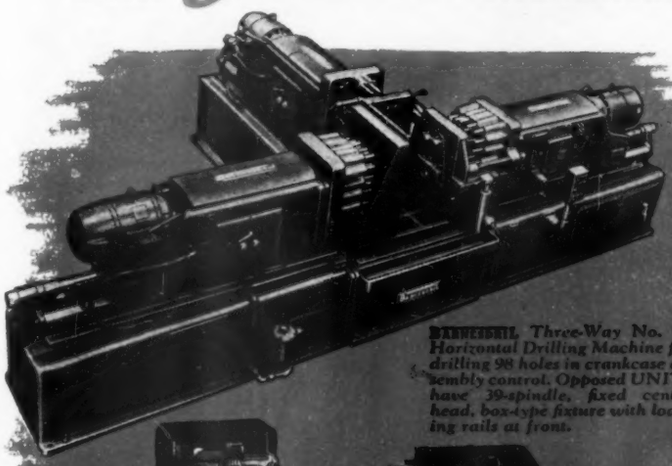
ASK FOR DESCRIPTIVE BULLETIN



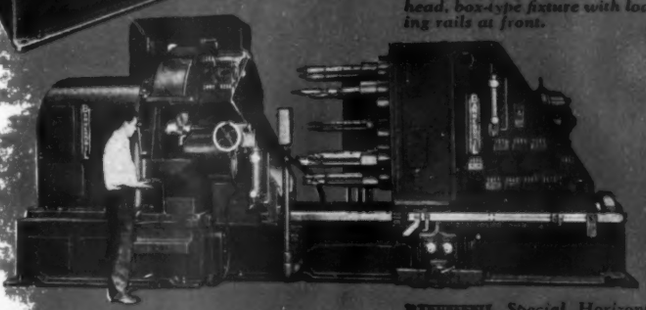
STOCK DELIVERY

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC 410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

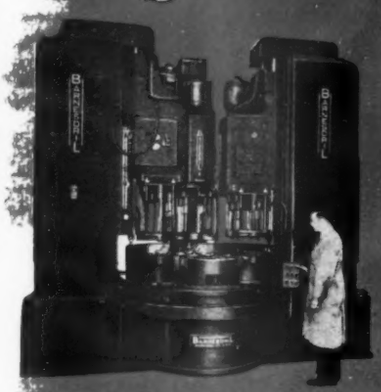
How to obtain
MAXIMUM PRODUCTION at LOWER COST
with *Standard* Machines for *Special* Operations



BARNESDRIL *Three-Way No. 20 Horizontal Drilling Machine for drilling 98 holes in crankcase assembly control. Opposed UNITS have 39-spindle, fixed center head, box-type fixture with loading rails at front.*



BARNESDRIL *Special Horizontal Drum Type Indexing Production Machine for drilling and taper reaming nozzle holes with traveling horizontal 34-spindle auxiliary head.*



BARNESDRIL *Three-UNIT Vertical No. 10 Hydraulic Production Machine for simultaneous machining operations on aluminum pump housing parts.*

BARNESDRIL *Three-Unit Machine for drilling 26 holes in rear axle housing. Vertical UNIT has 18-spindle auxiliary head. The two opposed horizontal UNITS have 8-spindle auxiliary heads.*

Here is complete information and data on BARNESDRIL Standard Hydraulic Units for *special* Drilling, Reaming, Facing, Boring and/or Tapping Operations. Write *today* for your copy of this Bulletin No. 150A.

● Where *special* drilling, reaming, facing, boring and tapping operations must be performed, BARNESDRIL Standard Hydraulic Units present a fast, low-cost method for specialized high production machining.

The unusual flexibility of BARNESDRIL Standard Hydraulic Units permits their arrangement in any vertical, horizontal or angular position (as shown), or they can be grouped around a rotating indexing table. A wide range of production work, limited only by size, design and construction of the workpiece, are regularly handled with BARNESDRIL Standard Hydraulic Units.

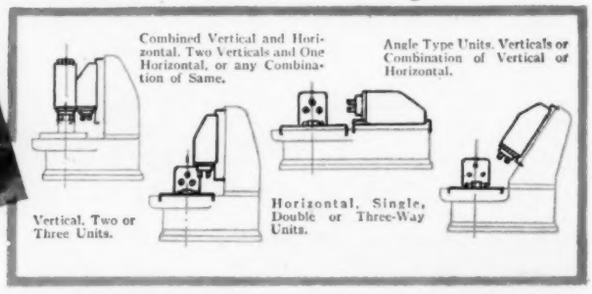
Completely self-contained, BARNESDRIL UNITS are arranged for the most efficient handling of the work, with a single motor driving the spindle rotations and hydraulic pump for any required automatic hydraulic feed cycle. Interchangeable single-spindle or multi-spindle auxiliary heads, with any required number of spindles, are easily mounted on the flange support of the UNIT.

Through the use of BARNESDRIL UNITS, engineering and development costs of *special* machines may be entirely eliminated. They are regularly available in the following three sizes, motorized according to job requirements:

No. 5 Unit.....with 5 to 7½ hp. motor
No. 10 Unit.....with 10 to 15 hp. motor
No. 20 Unit.....with 20 to 25 hp. motor
Drum Type and Specials..up to 75 or more hp.

They can be easily and economically converted from one high production setup to another, and their future use is practically unlimited.

BARNESDRIL UNITS give maximum production at lower costs—with worthwhile savings in both machining and handling time. BARNESDRIL engineers will assist you in adapting these UNITS to your *special* drilling, reaming, facing, boring and/or tapping operations. This service is available without cost or obligation.


Combined Vertical and Horizontal. Two Verticals and One Horizontal, or any Combination of Same.
Angle Type Units. Verticals or Combination of Vertical or Horizontal.
Vertical. Two or Three Units.
Horizontal, Single, Double or Three-Way Units.

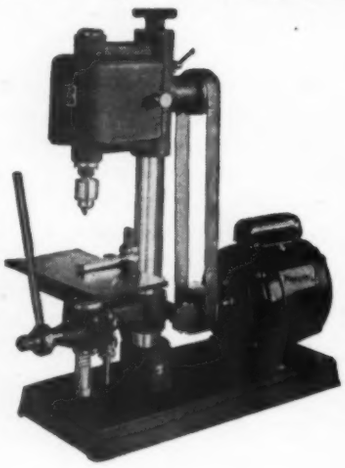
Barnes Drill Co.
830 CHESTNUT STREET
ROCKFORD
ILLINOIS, U.S.A.

When Minimum Fractional Precision Is Imperative

HAMILTON MACHINES

for better seeing • better feeling • better drilling

HAMILTON SENSITIVE TAPPER



More units per hour. For tapping operations on instrument, camera, watch, clock, business machines and all other precision work. Smooth, easy operation *without breakage of even the smallest taps.*

Fool-proof; noiseless; head mechanism is completely hooded so operator is protected from oil and dirt.

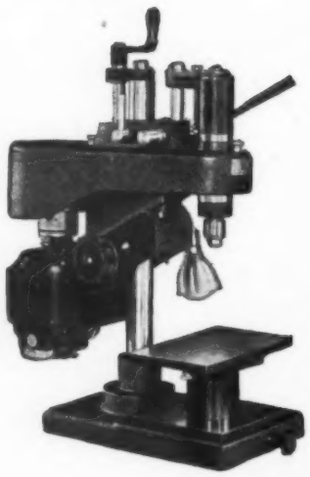
For any threadable material. From smallest and finest thread, up to and including 10-32.

• • •

HAMILTON "VARIMATIC"

Super-Sensitive Drilling Machine

for small holes .004" to 5/16" dia.



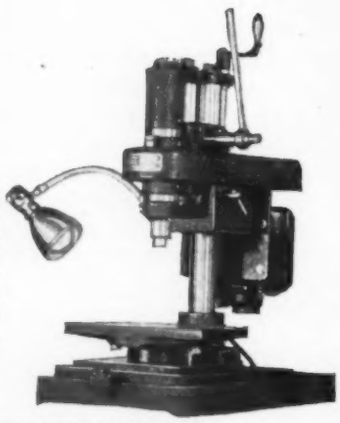
Two speed ranges, infinitely variable. Built with "instrument precision" for finest drilling in tool rooms, Diesel, instrument, electrical, aircraft and other uses. Bold in design, sturdy, convenient, perfectly constructed. Self-contained drilling unit swings radially on column and locks to any position. From 840 to 9300 r.p.m.

• • •

HAMILTON "MAXI-JR-E"

Super-Sensitive Drilling Machine

for small holes .004" to .250" diameter

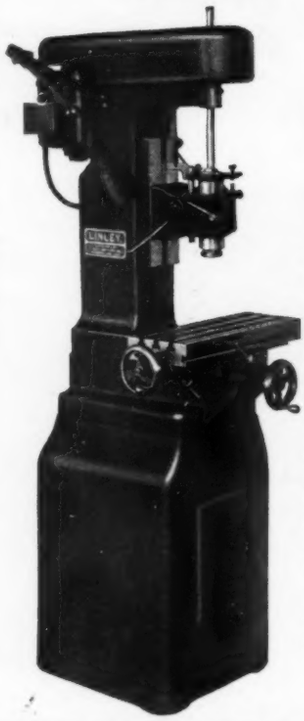


May be used singly or in gangs. Possible spindle speeds from 750 to 12,000 r.p.m. Full floating spindle designed to eliminate radial belt pull on the spindle. Within its capacity the extreme flexibility of MAXI-JR-E meets all requirements conveniently and economically.

WRITE FOR NEW BULLETINS

THE HAMILTON TOOL CO.
HAMILTON, OHIO

CLEAR THE SHOP OF *LITTLE JOBS* . . . WITH A MULTI-PURPOSE LINLEY



Keep down busy Tool Room costs with a versatile Linley where a wide variety of milling, jig boring, die and pattern work ties up machines with higher rated capacities.

This compact unit fits in any 2½ ft. square space and is easy to set up . . . has 8 spindle speeds to 4250 r.p.m. Entire assembly assures accuracy and velvet-smooth feed at all speeds . . . all rotating parts carefully balanced.

Don't hold up big jobs with a lot of little work—let a Linley speed them up. Examine its features now.

BULLETIN ON REQUEST

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONN.

LELAND GIFFORD

PRODUCTION ENGINEERS
at these Branch Offices will help you with your
DRILLING PROBLEMS.

CHICAGO, ILL.
565 W. Washington Blvd.
DETROIT, MICH.
1533 Dime Bank Bldg.
CLEVELAND, O.
P. O. Box 5547
NEWARK, N. J.
Industrial Office Bldg.
ROCHESTER, N. Y.
Commerce Bldg.
WORCESTER, MASS.
for New England

LELAND GIFFORD

WORCESTER, MASSACHUSETTS

MILLHOLLAND

Automatic DRILLING - BORING MILLING - TAPPING *Units*

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
Indianapolis, Ind.

Smooth Going

with

KENT-OWENS

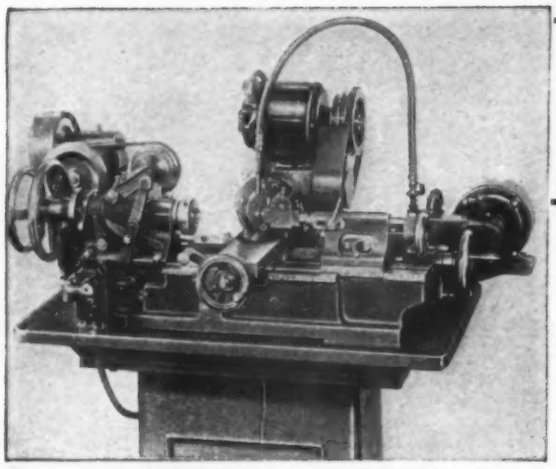
Milling Machines

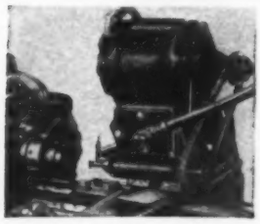
When you get set for the job with Kent-Owens Milling Machines... you can count on *steady production* without costly downtime! These machines meet today's demands for *greater speed and accuracy*... with practical features for simple and efficient operation. Ruggedly built... adaptable to a wide range of work. Write for latest bulletins. Kent-Owens Machine Company, Toledo, Ohio.

No. 2-20 Milling Machine
Table, 42" by 12"
Table travel, 20"

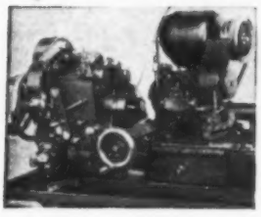
KENT-OWENS REPRESENTATIVES

BOSTON — General Machinery Corp.
BUFFALO — Dan W. Paterson
CHICAGO — Fred. Kohlbusch & Sissell
DALLAS — Hamilton-Hoover Mach'y Co.
DAYTON — Geuder, Mach'y Company
DETROIT — A. C. Hebenhorn Mach'y Co.
GRAND RAPIDS — Joseph Monthei
HOUSTON — Oliver H. Van Horn Co., Inc.
INDIANAPOLIS — Ostle-Bunch Machinery Co.
KANSAS CITY — Richmac Machinery Co.
LOS ANGELES — Burton & Davies Mach'y Co.
MILWAUKEE — Fred. Kohlbusch & Sissell
MINNEAPOLIS — The Sorenson Company
MOLINE — John J. Mesenpohl Co.
MONTREAL — P. P. Barber Mach'y Co.
NEW ORLEANS — Oliver H. Van Horn Co., Inc.
NEW YORK — Hastings-Wynne-Barron Company
PHILADELPHIA — Colon Machinery Company
PITTSBURGH — Bussey Machinery Company
ROCHESTER — F. W. Schieber Machinery Co.
SAN FRANCISCO — C. F. Bulotti Machinery Co.
ST. LOUIS — Hinchman & Normal Mach'y Co. — Clarke Equipment Company
SYRACUSE — J. F. Owens Mach'y Company
TORONTO — P. P. Barber Mach'y Company
WALKERVILLE — P. P. Barber Mach'y Company





(Left)—Waltham Thread Miller equipped with Internal Threading Attachment.



(Below)—Waltham Thread Miller equipped with Relieving Head.

WALTHAM THREAD MILLERS

provide versatility and precision in small thread production

Designed especially for small work calling for close tolerances, WALTHAM THREAD MILLERS can be depended on to meet the most exacting specifications for precision parts.

An outstanding feature of these improved machines is the use of three motors, one each for driving cutter, work and pump. Machines can be arranged with speeds suitable for brass or steel or both. Motors are wired so that a single start and stop station will control all at one time.

Standard equipment includes three motors with control, follow rest, milling cutter, indexing device, 5 pitch lead screw and change gears for cutting from 5 to 40 threads per inch.

A wide range of special equipment is available and greatly enlarges the usefulness of this machine. Full details on request. Write for Bulletin 244A.

CONDENSED SPECIFICATIONS

Swing over carriage—3"
Dia. work handled—2" or smaller
Thread length (work held on centers) —8¾"
Thread length (work held in chuck)—10"
Max. Dist. between centers—12"
Floor Space—48"x34"
Net Weight—850 lbs.

WALTHAM
TRADE MARK REGISTERED U S PAT OFF

WALTHAM MACHINE WORKS,
WALTHAM, MASS.

PORTAGE

HORIZONTAL BORING, DRILLING AND MILLING MACHINE NO. 4

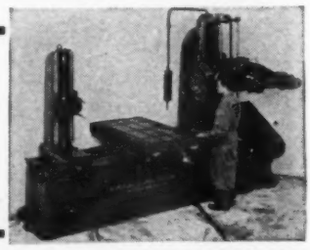
• Featuring an extended saddle and table with outer rail support for maintaining exceptional accuracy on long work. Get fully acquainted with the many features of this modern Boring Mill. *Ask for a copy* of our new instructive bulletin which points out the numerous advantages of this new Horizontal Boring, Drilling & Milling Machine.

THE PORTAGE MACHINE CO.
AKRON 11, OHIO

UNIVERSAL *Horizontal Boring Machine*

The only TRIWAY *Boring Machine Built*

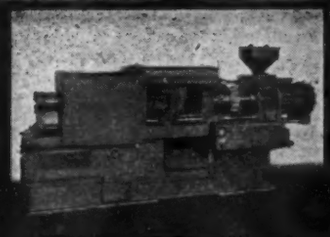
Made in 3", 4" and 5" spindle sizes.
Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

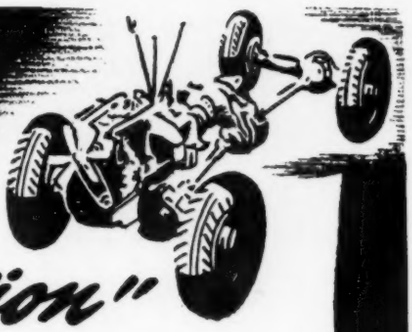
REED-PRENTICE

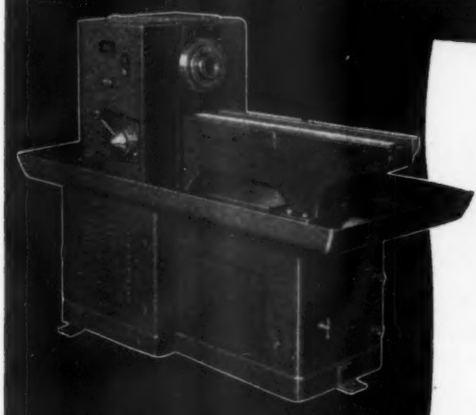


LATHES • JIG BORERS
DIE SINKERS •
DIE CASTERS •
VERTICAL MILLERS
INJECTION MOLDERS

REED-PRENTICE CORP.
MACHINE TOOLS
WORCESTER MASS. U.S.A.

Like a Truck Chassis



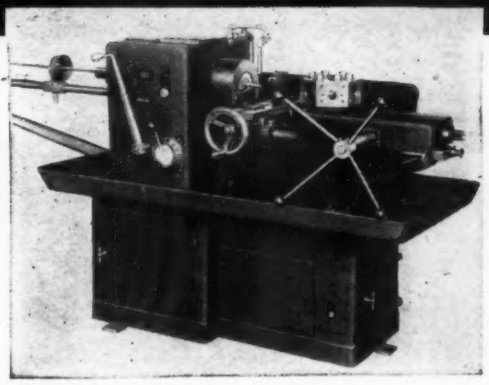


Above view shows the basic machine complete to the point of adapting it to YOUR specific requirements.

THE OSTER "*Rapiduction*"

Turning machine chassis is the starting Point for a wide *DIVERSITY* of Individual Applications

or, You can have it as a Complete Machine



Now, as formerly, the Oster No. 601 "RAPIDUCTION" machine can be furnished equipped with automatically indexed, 6-position turret (as illustrated at right) or with plain saddle and single tool post (as illustrated below).

Two types of drive are optional with the machine: WORM DRIVE or DIRECT DRIVE. Another option is the 4-speed motor (permitting four speed changes without change of sheaves) or the 2-speed motor, as required.

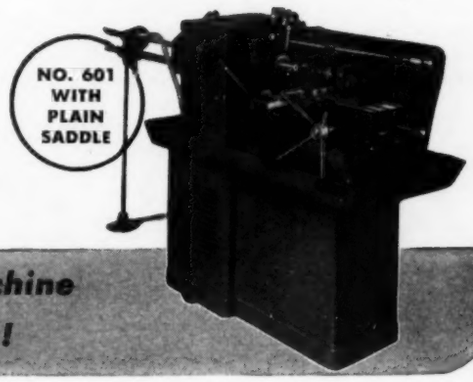
A truck chassis has no monopoly on diversified applications. With a truck chassis as a starting point, almost any specific requirements for a COMPLETE truck can be designed. Comparable flexibility of application is provided by the Oster No. 601 "RAPIDUCTION" turning machine chassis. Once your individual needs are established, either your engineers or ours can readily adapt this machine at minimum cost compared with a special machine. No. 601 "RAPIDUCTION" gives you the economy of a STANDARD machine right up to the point of where you may require certain special equipment. That means ECONOMY from the floor up! If you believe this proposition merits careful investigation, write . . .

THE OSTER MANUFACTURING CO.
2049 East 61st Street • Cleveland 3, Ohio, U. S. A.

OSTER

"*Rapiduction*"

The STANDARD *Turning Machine* with CUSTOM-BUILT *Features!*



TROUBLE-FREE CLUTCH

for Heavy-Duty Drives

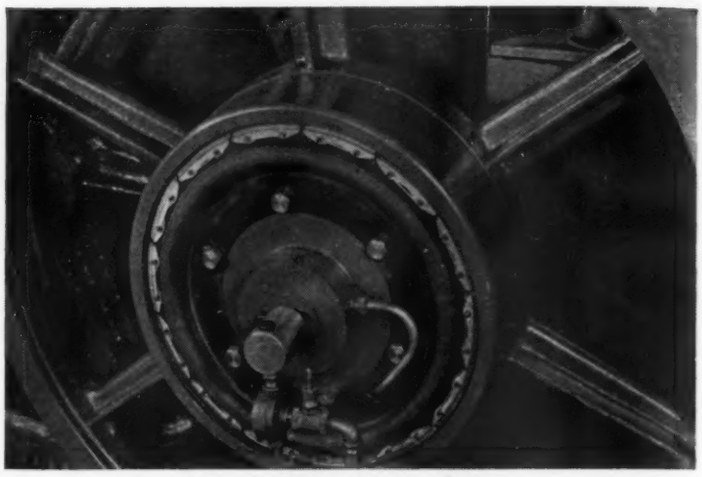
The Fawick Airflex Clutch controls power and torque, and absorbs shocks and vibration, through a cushion of air.

It needs no arms, springs or levers—requires no lubrication or adjustments. There is nothing to get out of order or require frequent replacement. Wear is slow—maintenance is low.

Performance and economy are being proved every day on hundreds of types of heavy-duty drives.

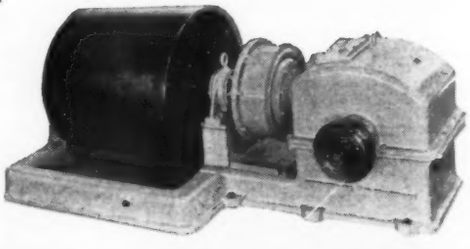
* * *

Fawick Clutches are engineered for the job. Tell us the conditions your equipment must meet and we'll gladly make recommendations. Book on request.

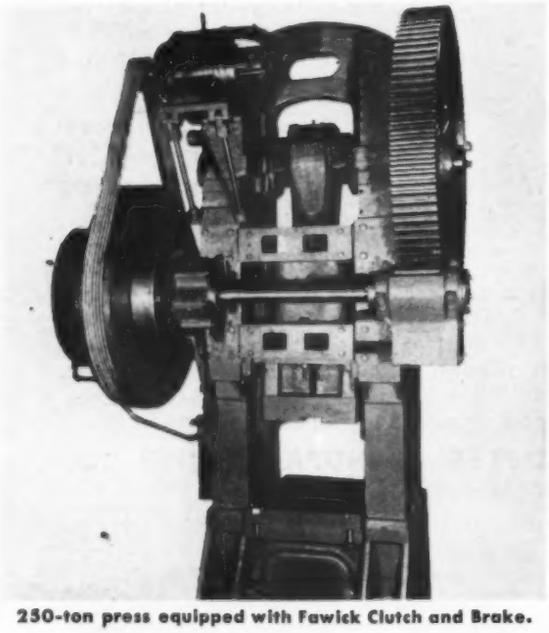


Fawick Airflex Clutch assembly

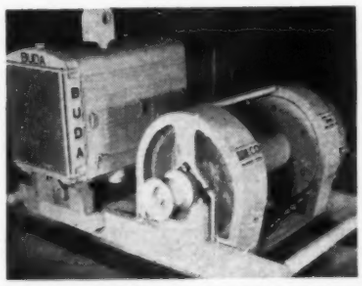
Fawick Clutches are providing new efficiency for shovels, cranes, draglines and hoists.



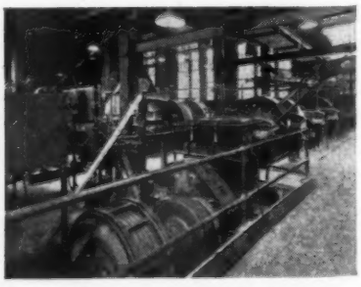
Paper machine drive unit, equipped with moistureproof Fawick Clutch.



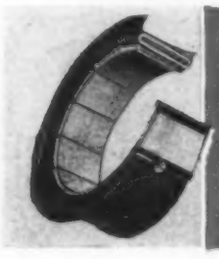
250-ton press equipped with Fawick Clutch and Brake.



Ideco service winch with Fawick Clutch for drum drive.



Trouble-free Fawick Clutches are finding many applications in the rubber industry, too.



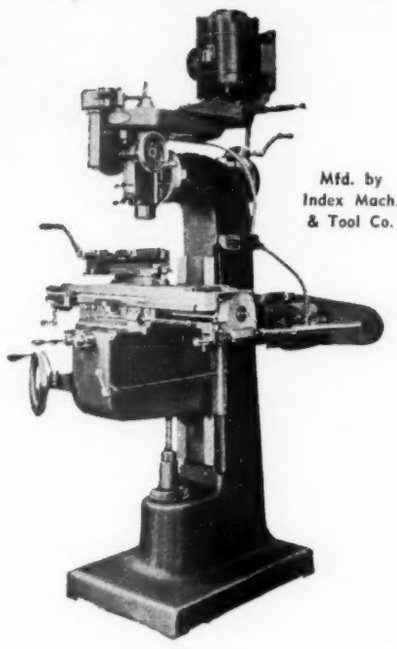
FAWICK *Airflex* CLUTCH

FAWICK AIRFLEX CO., INC. • 9919 Clinton Road, Cleveland 11, Ohio

In Canada, Reynold-Coventry Ltd., Montreal, Toronto, Vancouver • In Britain, Crofts Engineers, Ltd., Bradford, England

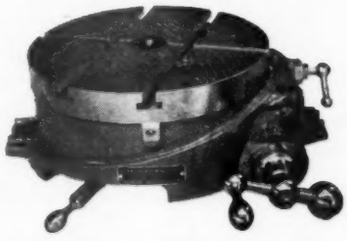
INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table



A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

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EDWARD *Blake* COMPANY

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Keep SMALL Cutters SHARP with ORIGINAL accuracy on the small

Waltham

CUTTER SHARPENER

The LOGICAL way to sharpen *small* cutters is on a *small* cutter sharpener. One *designed* for the job. One which will *keep* small cutters at original sharpness and original accuracy over a long productive life.

The bench-size Waltham Cutter Sharpener fulfills all of these requirements. It was designed by the Waltham Machine Works—small cutter manufacturers for many years—for the sharpening of their own precision cutters. It is now available to help you solve your cutter sharpening problems. So don't tie up your big tool and cutter grinders doing small-size work. Use the *right* machine for the job—a precision tool—the Waltham Cutter Sharpener. This versatile machine sharpens gear and thread milling cutters, circular form tools, straight-fluted hobs, and multiple cutters up to 3 inches diameter and ⅜ inch thickness.

The WALTHAM can be used for either radial or rake grinding. It operates either with precision index plates or with a pawl device for locating on top or back of the teeth.
Your WALTHAM will:

- ★ Keep your small cutters *in production*—that's why you bought them.
- ★ Get more production out of every "cutter dollar."
- ★ Save you from buying many cutters of the same size—reduce your investment and overhead.

The coupon below will bring you complete details, without obligation.

Please send me Bulletin No. 345 which gives full details on the Waltham Cutter Sharpener. A.M.

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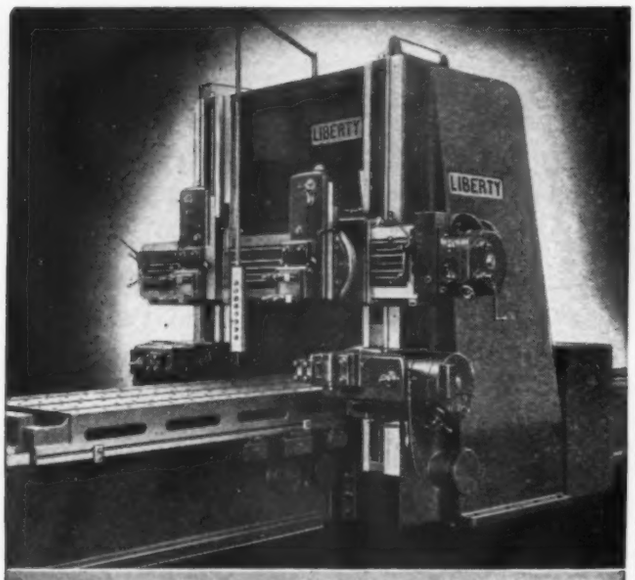

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NO. 15
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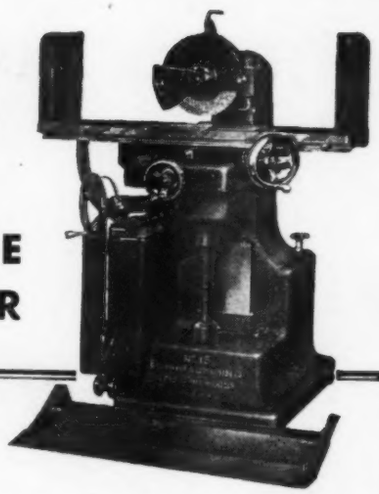

. . . a rugged machine for fine, accurate work

This high grade, motor driven machine will handle all work within its capacity with maximum convenience. Among the features which assure fine, accurate work and long precision service are the following:

. . . heavy, one-piece column and base
. . . precision ball bearing spindle
. . . careful guarding of wearing surfaces
. . . provision for wet grinding

This machine can be furnished with coolant system or dust collecting system.

Longitudinal Table Movement—19"
Transverse Table Movement—8½"
Vertical Movement—12"
Table—6"x18"

Send for illustrated literature giving further details.

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Accurate ... Well built ... Good Delivery

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❶ **R.F.C.** For that machinery which will give you good productivity.

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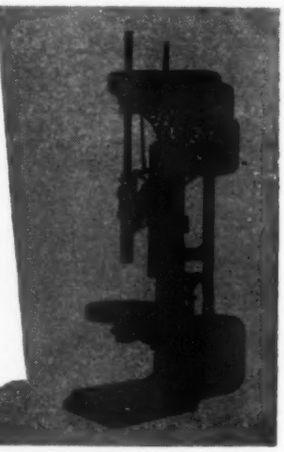
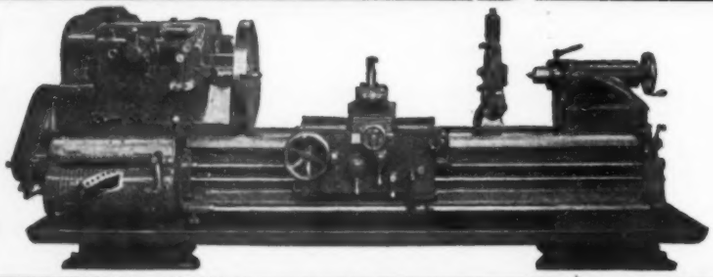


SPRINGFIELD GEARED HEAD LATHES



for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes —flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

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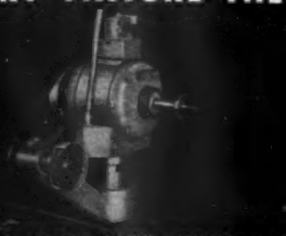

B640 HIGH SPEED GRINDING ATTACHMENT

B643 MOTOR DRIVEN WORK HEAD

B685 RADIAL GRINDING FIXTURE

B642 LARGE SENSITIVE WORK HEAD

B647 TAP GRINDING FIXTURE

A642 SMALL SENSITIVE WORK HEAD

A645 TILTING TABLE ATTACHMENT

B670 SPIRAL HOB AND CUTTER GRINDING FIXTURE

Knock-Out Engineers have made availabie more time-tested grinder fixtures than has any other manufacturer. If it can be done—it can be done more easily and economically on a K-O Grinder.

Model B600 Single Speed Universal Tool Grinder.

Write Knock-Out at Aberdeen for booklet No. **27-16.**

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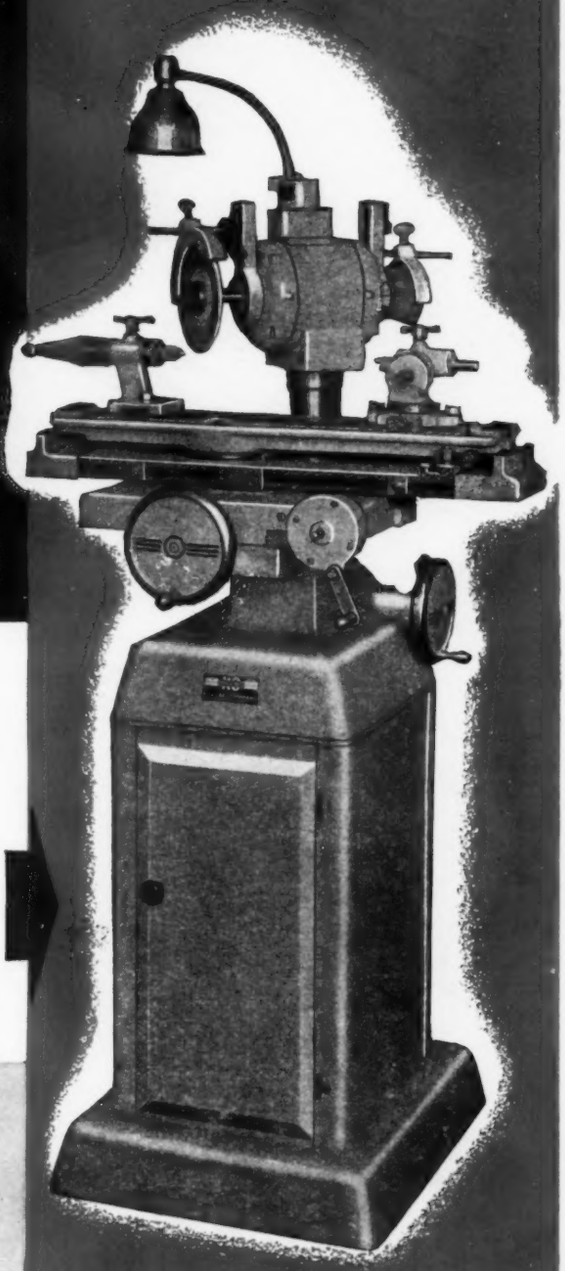

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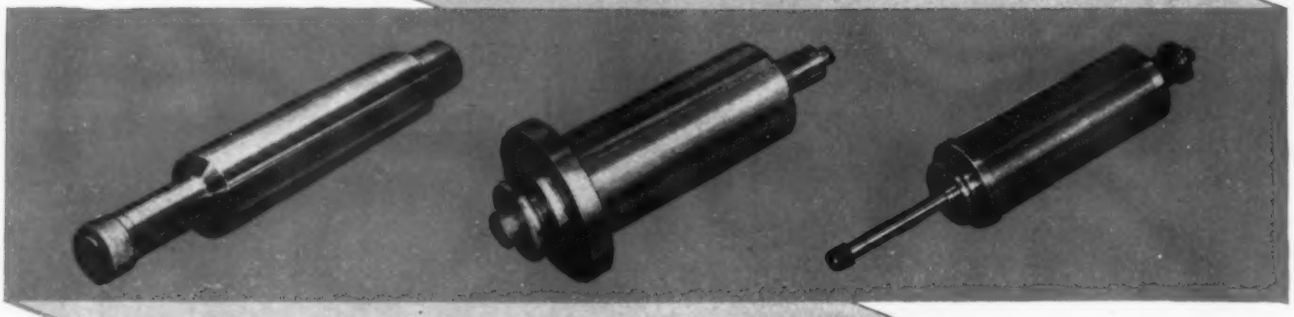
POPE

with lubrication Sealed-In



BETTER FINISHES and MORE ACCURATE DIMENSIONS
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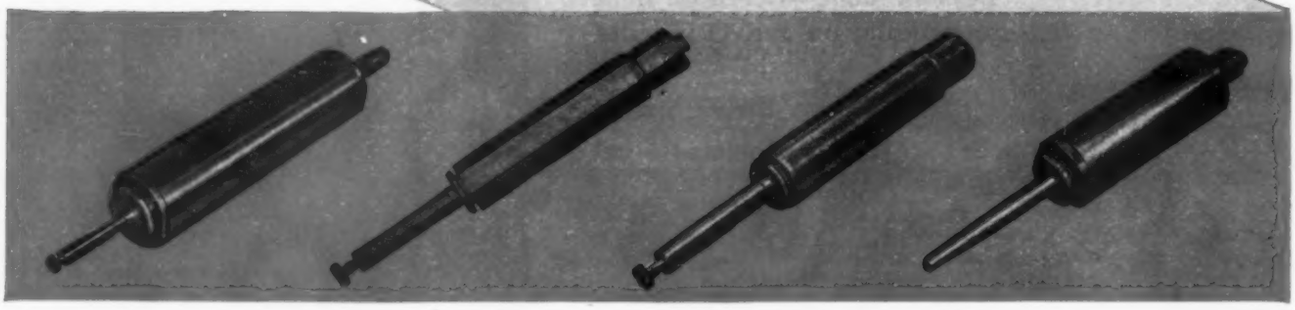

Send us sketch or outline drawing of the spindles you require.
We will be glad to submit recommendations and quotations.

No. 29

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ESTABLISHED 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS
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DIE STEELS FOR COLD WORK *

Colonial 6—Non-Shrinkable

For die applications where size and shape must be maintained closely, without grinding after heat treatment. Oil hardening, manganese types.

Red Star Tungsten

Oil or water hardening to a very high degree, combined with excellent toughness and wear resistance. Tungsten, chromium, vanadium and molybdenum alloy.

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For intricate dies, with very low movement when air cooled. Easily machined when annealed—no cracking tendency in hardening. Chromium-molybdenum type.

Crocar

High carbon, high chromium alloy; highly wear-resistant when heat-treated, yet readily machined in annealed condition. Oil hardening.

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Closely related to Crocar, but air hardening, with slightly lower carbon content, and high toughness values. Low movement in hardening.

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A water hardening tungsten steel capable of intense hardness and wear resistance. Ideal where hard case and tough core are required.

All of the above steels are available in bars, rods and drawn shapes, also forgings, ring forgings, sheet, plate, discs, and billet rods.

Vanadium-Alloys
STEEL COMPANY
LATROBE, PA.

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. . . Put Your Small Work on a Production Basis!

Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

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The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

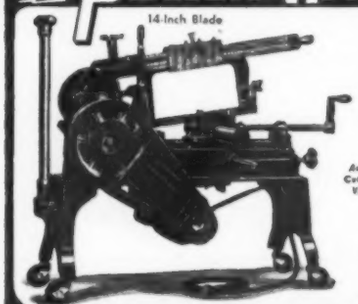
Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
403 EXCHANGE ST. ROCHESTER, N. Y.

POWER HACK SAW ★



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For cutting internal keyways, slots or splines 1/10" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

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MITTS & MERRILL
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Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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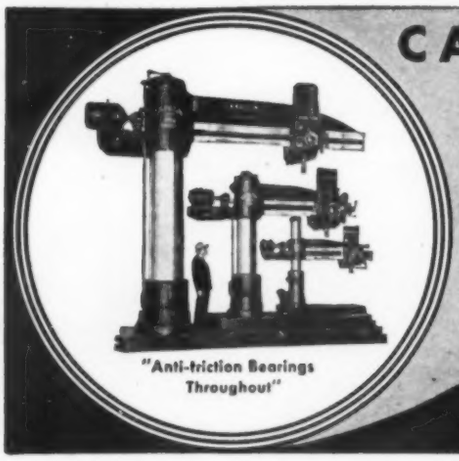

FEATURES—1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

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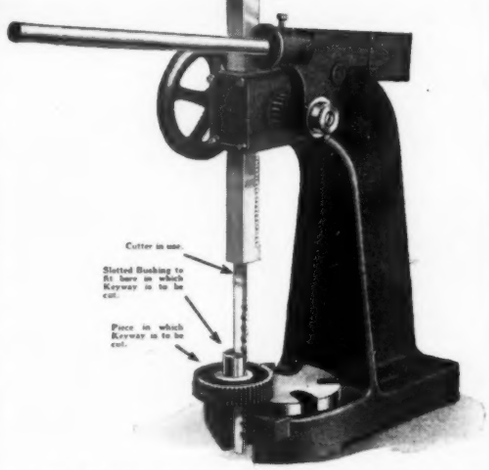
Threadwell Keyway Sets take care of every keyway you're likely to need. They come complete with slotted bushings, broaches, and shims.



The Threadwell Arbor Press is just the ticket for use with Threadwell Keyway Cutters. Takes work up to 14" dia., 15" stroke. Hand leverage 48 to 1. Threadwell quality through and through. Ask for it at your Threadwell distributor's.

YOU CAN CUT KEYWAYS IN 60 SECONDS WITH *Threadwell* KEYWAY CUTTERS

There's nothing to it when you have this handy Threadwell Keyway Cutter Set. All you do is drop in the bushing that fits the bore, put the broach in the bushing's slot and press it through, once with the cutter alone, and again with shim to give you the depth you want. One minute and it's all done!

Keyways in gears, collars, pulley hubs, couplings, milling cutters, or what have you, are cut to standard width and any desired depth. Any number of keyways can be cut in a single bore and accurately indexed.

Here's one of the greatest little time and money savers in the shop. Anyone who has even an occasional keyway to cut will find that this Threadwell Keyway Cutter Set will pay for itself in short order. It's made to the same standards of quality and precision as *Threadwell Taps of Distinction.*

Ask your local Threadwell distributor to give you the whole story on Threadwell Keyway Cutter Sets and Threadwell Arbor Presses.

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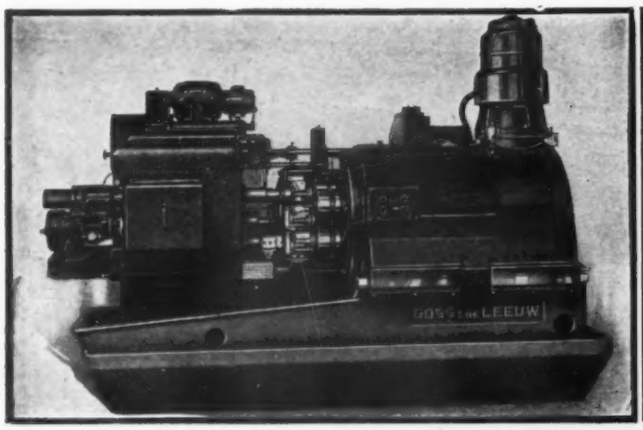
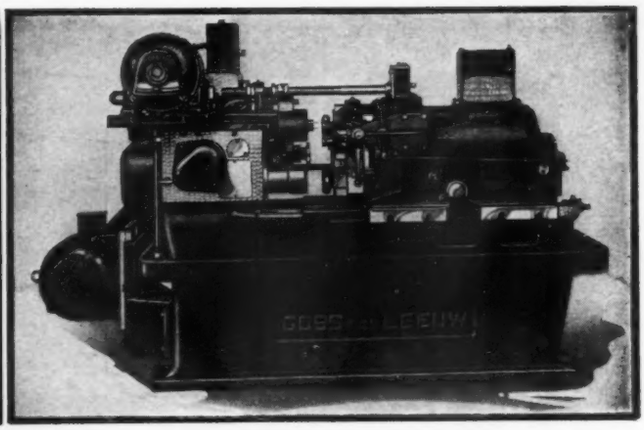
SINCE 1902
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

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FOR CONTINUOUS

HIGH DUTY PRODUCTION

Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾" N.C. and 1½" N.C. Threads in alloy steel offers these features: Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

Complete information upon request.

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MANITOWOC, WISCONSIN

The Cincinnati

WET ABRASIVE CUT-OFF MACHINE

. . . for straight or angle cutting of practically any material used in general manufacturing . . . including such metals as brass, copper, aluminum, as well as fibrous and plastic materials in various sizes, angles and shapes.

Suitable for making straight or angle cuts in solids up to 2¼" or tubing up to 3½" diameter. Same vise is suitable for various cuts. Maximum capacity is 2¼" in cutting angles up to 45°. Graduations on table make angle-cutting fast and accurate.

Alternating or direct current.
Write for complete details.

The Cincinnati

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BUFFERS · PORTABLE TOOLS
AIR MASTER DUST COLLECTORS

ELECTRICAL TOOL CO.
Division of THE R. K. LeBLOND MACHINE TOOL CO.
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Positive action of BARRETT TYPHOON CENTRIFUGAL WASHERS provides for quick, thorough parts cleansing

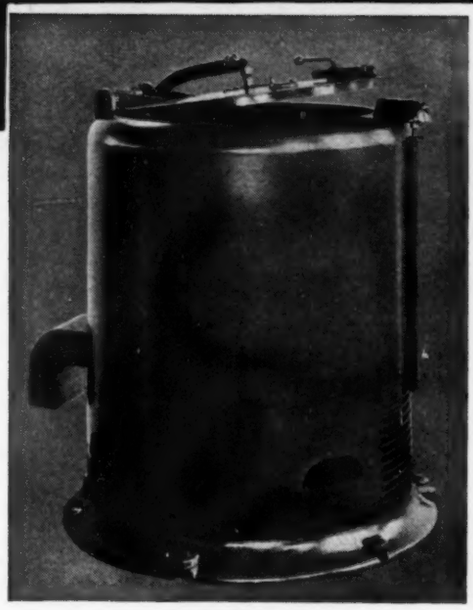
In these efficient centrifugal machines the washing solution enters the top of the whirling load under valve control. The operating principle—being that of a typhoon—gives the washing solution a spraying, swirling, and surging action which thoroughly permeates the contents. During this action, centrifugal force creates hydrostatic pressure within the basket. That proportion of the deluge going to the bottom is forced up the side and out carrying off the contaiminated fluid.

A thorough, quick cleaning is definitely assured by flowing sequence. Two or more liquids may follow, making it possible to wash, rinse or provide any further treatment as required.

Several Barrett installations involve the use of four machines operated by one man who loads and unloads in three minute cycles. Washing time is only one minute. Another type of set-up provides for recovering oil, washing, drying, and coating with rust-proofing material.

As in all Barrett Centrifugal machines, provision is made for convenience and safety of operation.

Send at once for details of Barrett Typhoon Washer



Barrett Centrifugal Washer—made in capacities from 13 to 36 cu. ft. per hour. Each size, depending on condition, will perform at the rate of 20 duty cycles per hour.

THE LEON J. BARRETT COMPANY, 1800 Grafton Road, **WORCESTER, MASS.**

Designers and Builders of Centrifugal Machinery

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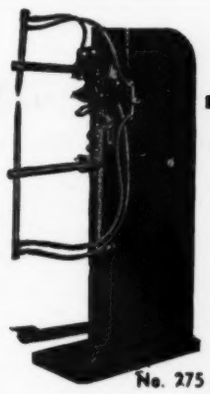

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CONSULT US *for* YOUR REQUIREMENTS

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SPOT WELDERS

AIR OPERATED WELDERS

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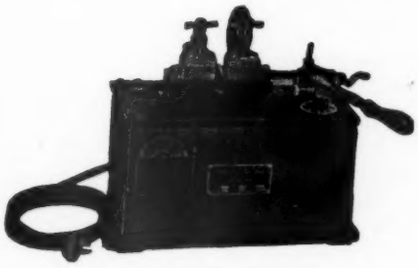
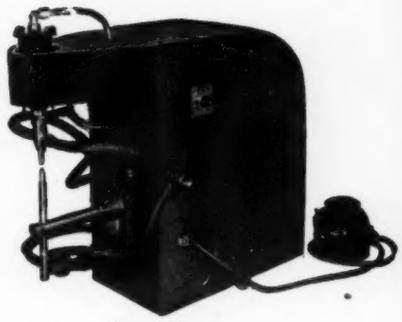
LIGHT GAUGE METALS



No. 141 & No. 241-CG



No. 263-A

WELDEX INC. **7324 McDonald Ave., DETROIT 10, MICH.**

CARD SPIRAL POINTED TAPS

for free, accurate thread cutting in deep holes

Designed for tapping deep through holes or blind holes drilled deeply enough for chip clearance at bottom of hole. Cutting is done by the first few threads milled at an angle. Chips are forced ahead of tap, preventing chips clogging in flutes, thereby increasing strength of tap and minimizing chances of breakage.

CARD SPIRAL POINTED TAPS assure free cutting, and fine quality threads. Furnished in carbon steel and high speed steel types. Fully described in Card Catalog, available promptly on request.

CARD TAPS ARE SOLD BY LEADING DEALERS EVERYWHERE

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USE *Fluid-motion* **for modern form-dressing**

ONE SETTING HANDLE CONTINUOUS MOTION

J & S Radii & Angle Dressers in the "Fluid-Motion" series are among the finest precision dressing instruments procurable. . . . regardless of cost. There is a standard model to fit most form-dressing requirements.

FEATURES

Fluid-motion dressing
.0001" accuracy
Automatic centering
7" & 14" wheel capacities
Large range yet compact
Chatterless and dustproof

J. & S. TOOL CO.
477 MAIN STREET
EAST ORANGE 1, N. J.

GRINDING WHEEL DRESSER

Desmond Cutter *Desmond Hex Dresser*

We munufacture a complete line of Dressers and Cutters.
Write for copy of catalog "A".

DESMOND-STEPHAN MFG. CO.
URBANA, OHIO
Canadian D-S Mfg Co., Hamilton, Ont.

RANDALL & STICKNEY
Universal Gauge

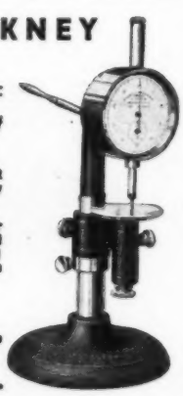
for rigid inspection of a wide range of parts .

An almost unlimited use is offered by this instrument for inspecting duplicate parts in quantity or any small parts with flat surfaces or recesses.

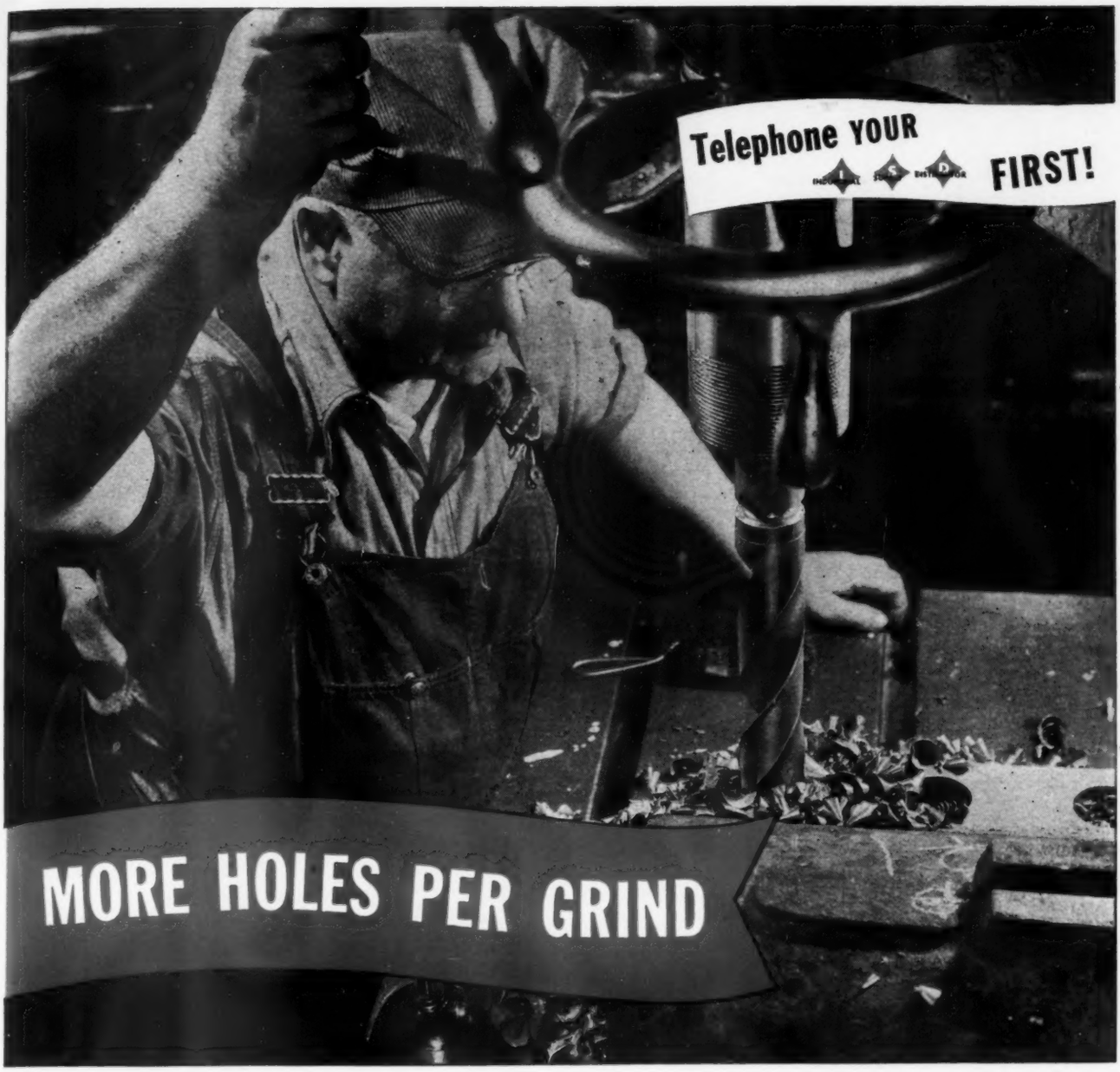
Use of standard blocks made possible by raising or lowering table increases capacity to take material up to 2" in height. Graduated to read to .001 inch; height 9¾"; weight 5 lbs. 1¼ oz.; depth from frame to spindle 1⅝".

Full details on request

Can be supplied with sliding head and table; also on a stand with throat 3" deep.



FRANK E. RANDALL CO.
Makers *Waltham 54, Mass.*



with CLE-FORGE HIGH SPEED DRILLS

● CLE-FORGE Drills are not only the finest twist drills you can buy, but also are the most economical. Figured on the basis of *cost per hole,* they give the biggest dollar value. The same economy can be obtained with other CLEVELAND tools—Reamers, Screw Extractors, Arbors, Mandrels, Sockets, Mills and Counterbores.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

80 THOMAS ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
4515 SECOND BLVD., DETROIT · BRUNEL ROAD, OLD OAK COMMON LANE, ACTON, LONDON W. 3, ENGLAND

HERE'S WHY You SHOULD USE BOKUM BORING TOOLS

- Helical relief maintains constant clearance angles entire life of tool.
- Finish lapped cutting surfaces produce better bores with faster feeds.
- Resharpening confined to one face.
- Down time for regrinding reduced.
- Unskilled help can use tools without loss of efficiency.

★

Send for catalog that shows all sizes and prices.

★

Ask for No. K-1139 for super high speed tools and for No. K-398 for carbide tipped tools.

BOKUM TOOL CO.
TRADE MARK REG. U. S. PAT. OFF.
14775 WILDEMERE AVE. · DETROIT 21, MICH.

NO. 101 "PRODUCTION" Centerless Feed Polishing Machine

FINER FINISHING WITHOUT SKILLED OPERATORS

Send for folder giving full detailed information

More and better finishing of cylindrical work at lower cost is assured by this machine even in the hands of inexperienced operators. Work is fed automatically, an index showing position of the feed at all times. This machine will handle cylindrical work from ¼" to 6" diameter and is ideal for superior polishing of tubes, rods, bars, etc. Wheel can be trued with machine in operation. It can be furnished in tandem of two or more for multiple finishing.

PRODUCTION MACHINE CO.

Manufacturers of Tool Grinders and Hand and Automatic Polishing and Grinding Machines.

GREENFIELD, MASS., U. S. A.

Reconversion Reminder:

Send your Gage Blocks in for inspection before the big rush begins!

YOU'LL want your Gage Blocks in perfect condition for the competitive days of peacetime manufacturing ahead! NOW is the time to send them in to Ford for inspection. The cost is only *20 cents a block* (f.o.b. Dearborn) for A and B Gage Blocks up to one inch and for each inch of length of longer blocks. (Minimum charge $1.) You'll receive an itemized Certificate of Inspection showing you which blocks, if any, need reconditioning to restore their original accuracy (.000004" or .000008" ±). Details and prices of reconditioning, including the Ford chrome-plating method, will be found in the new Jo-Block Catalog No. 17. Write for your copy today. Ford Motor Company, Johansson Division, Dept. 11, Dearborn, Michigan.

NEW! Catalog 17—just published. Write for your copy!

Ford

Johansson GAGE BLOCKS

SPECIAL CONTROL PANELS

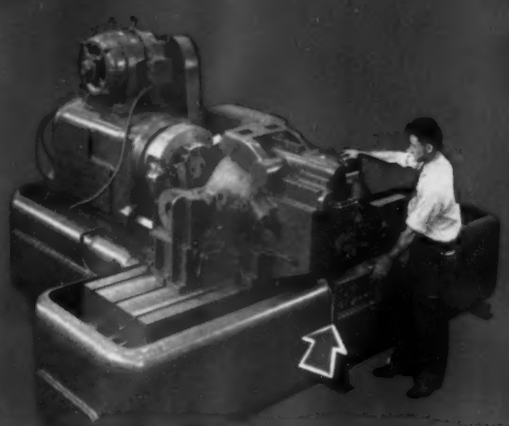
assembled from standard A-B units

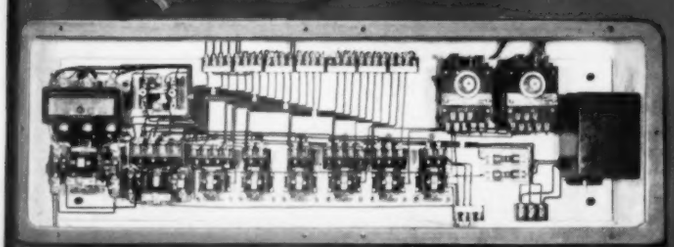
to fit your machines

Machine tool builders are concentrating their electric switching units more and more on single control panels . . . using various combinations of standard Allen-Bradley solenoid switches and relays to meet their special operating needs.

Allen-Bradley control engineers are available to machinery builders for control engineering counsel. They will gladly co-operate with you in developing special panels to satisfy the operating requirements of your machine.

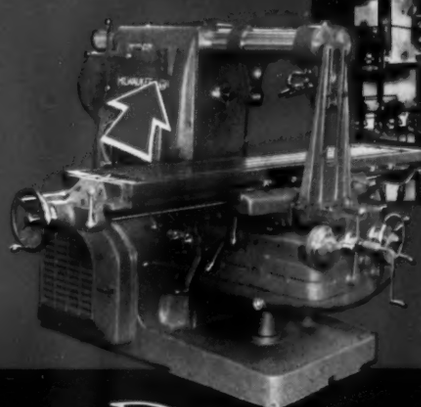
MATTISON moulder panel with mechanically interlocked contactors for dual frequency speed control.





CROSS COMPANY axle housing boring machine panel using various types and sizes of Allen-Bradley contactors and relays. Remote control from push button panel near the operator.

KEARNEY & TRAECKER milling machine panel for controlling 50 hp motor and other units of this carbide steel milling machine. Push buttons are mounted upon the milling machine. The panel is mounted separately in a steel cabinet.



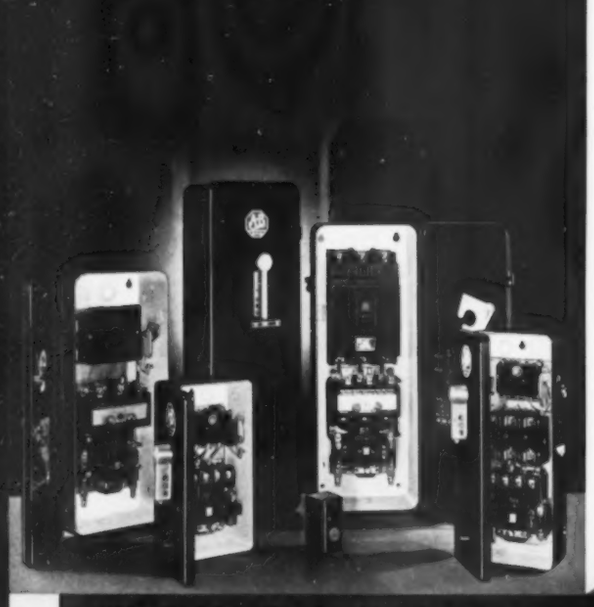
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

BULLETIN 609 Manual Starters

BULLETIN 709 Automatic Starters



BULLETIN 712-713 Combination Starters

3 POPULAR LINES

These three lines of Allen-Bradley starters will handle over 90% of all motor control applications:

BULLETIN 609 Manual Starters for manual control of motors up to 5 hp, 220 v and 7½ hp, 440 to 600 v.

BULLETIN 709 Automatic Starters for remote control of motors up to 50 hp, 220 v; 100 hp, 440 to 600 v.

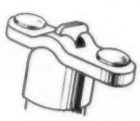
BULLETIN 712 Combination Starters for remote control of motors up to 50 hp, 220 v; 100 hp, 440 to 600 v, plus built-in disconnect switch.

All of these starters are available in a wide variety of enclosures. Because of the compactness of the starter mechanism, all enclosures allow generous wiring space. The white interior illuminates the starter in dark locations. Write for Bulletins 609, 709, and 712-713 today.

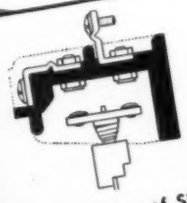
Allen-Bradley Company
1316 S. Second St., Milwaukee 4, Wis.

All 3 have
Double Break Silver Alloy Contacts

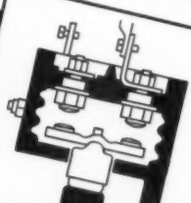
There is no contact maintenance with these 3 popular lines of starters. All Allen-Bradley starters are good for millions of trouble-free operations. This is due to the simplicity of construction of the individual switching units. They are unusually rugged in construction.



NEVER CLEAN • FILE • OR DRESS THESE CONTACTS

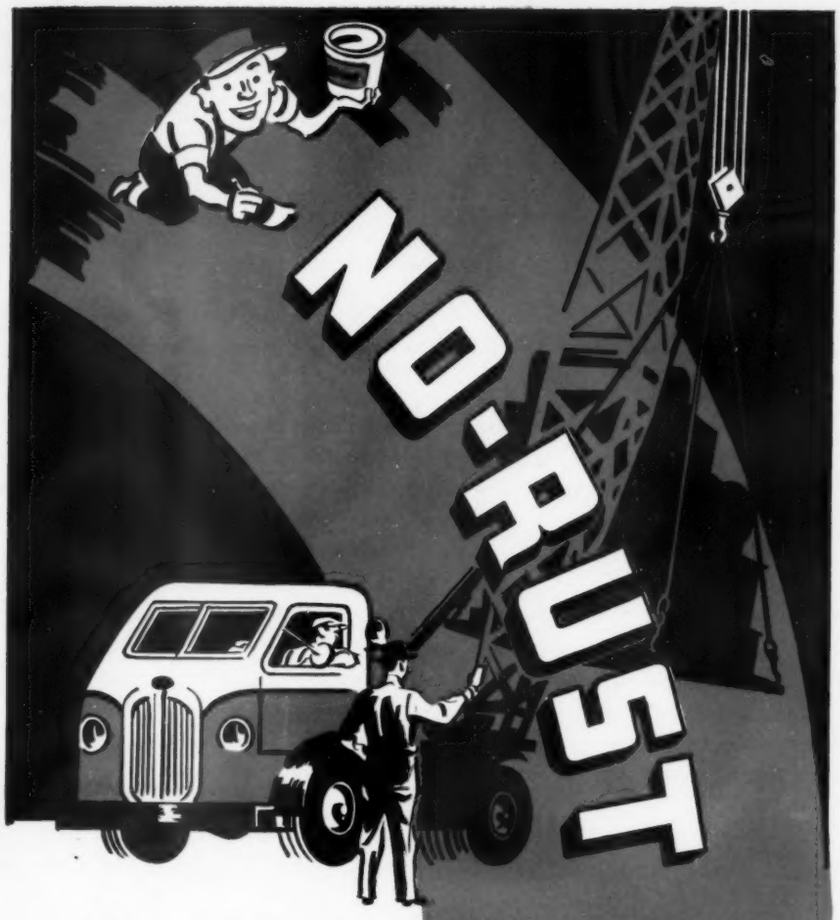


Sectional view of Sizes 0 and 1 contactors showing double break contacts.



Sectional view of Sizes 2, 3, and 4 contactors showing enclosed arc hood.

ALLEN-BRADLEY
TROUBLE-FREE MOTOR CONTROLS



Attention American Machinist Advertisers and Readers!

Are Your Products Adequately Protected Against a Most Destructive Enemy . . . Rust?

Thousands of dollars of metal materials, equipment and products, *stored* and in *transit*, that are subject to rust and corrosion, are completely protected with NO-RUST. A few dollars of NO-RUST are doing the job . . . In every case . . . In every climate.

YOU WIN!!

No matter what your present requirements and future plans, no matter what you may be using, have NO-RUST speak for itself. Use of anything that protects less, or costs more, is a needless risk and a waste. NO-RUST eliminates both.

NO-RUST SPEAKS

Applied quickly. Dries fast, hard, smooth. Proof against wear, weather, abrasion, chipping. Stays indefinitely. Removed easily. *Write for adequate Sample today. Free!*

Frost

PAINT AND OIL CORPORATION

"The EXACT Finish for EXACTING Needs"

1209 N. E. TYLER ST. • MINNEAPOLIS 13, MINN.

RUST RESEARCH AND PREVENTION

By M. C. SLACK
Vice President Frost Paint and Oil Corp.

Our first experience with rust no doubt was with iron posts eaten through and broken at the ground line, or the corn plow among the weeds back of the barn, and other implements that had to be cleaned and new parts assembled every Spring before they could be used.

Rust always occurs in iron when these three factors come together—water, oxygen and "impurities". Ordinarily this impurity is provided by the carbon dioxide of the air, or by the numerous elements present in small quantities in commercial iron, such as carbon, sulphur, phosphorus, etc. The action of the impurity is to provide a feebly conducting solution with the water, and so set up an electrolytic effect whereby salts of iron (the sulphate or carbonate) are first formed and then decomposed by the oxygen.

That is the simple way in which rust, one of the most destructive of saboteurs in industry and commerce, works.

The results of research by the Frost Paint & Oil Corporation Engineers, over a period of many years and countless experiments is an unusual product —NO-RUST . . . now available in commercial quantities at a low cost that makes the proved and accepted compound economical to use. NO-RUST, as its name suggests, prevents the process by which rust is formed, from starting.

In addition, to be practical in use, NO-RUST is impervious to wear and abrasion. It had to dry to a hard, smooth, non-sticky surface to permit handling without loosening its bond on the metal. It had to be elastic enough to expand and contract with the metal and also to be free from chipping, and also to be easy of removal.

After many experiments, tests, and use in all and every conceivable condition, NO-RUST was developed. Inasmuch as it contains all of these factors, it gives commerce and industry the absolute, positive protection against rust with ease of application and removal, and low cost that makes it an economy and an insurance against positive loss.

—*adv.*

Special HOEFER Unit

. . DRILLS AND REAMS THREE DIFFERENT CYLINDER HEAD PARTS

• Typical Diesel Cylinder Head ... drilled and reamed 51 feet per minute, ... r.p.m., .010-inch feed, 1½ travel—requires only 31 ... total time.

★ This interesting 27-spindle full anti-friction head, with three groups of spindles is capable of being driven in individual groups by engaging drive through one of the three gear shift buttons shown. Forced cascaded lubrication provided in head which was driven by vertical hydraulic feed driller. This head in combination with the fixture we furnished drills the bolt holes in three different sizes of Diesel engine cylinder heads.

This Hoefer Multiple Spindle Head is an example of the ability of Hoefer engineers to meet the most unusual hole drilling requirements, giving you a simplified method and one that ... time and cost saving. Hoefer Heads are attachable to your own drill presses or turret lathes. Among the benefits are savings in floor space as well as the cost of new machinery. Having designed thousands of heads our engineers can easily develop a multiple drilling head to fully meet your specific needs. Write, telling us about your job.

Hoefer's Whole Business is Holes

HOEFER MFG. CO. *Freeport, Ill.*

YOU WIN!!

20" x 96" Hi-Power
12" High
Weight 6,300 lbs.

WHAT IS YOUR PROBLEM?

- The above display illustrates the diversified demand for WALKER CHUCKS.
- Increase your Productive Efficiency by the use of WALKER MAGNETIC CHUCKS.
- Less fatigue on the part of your operating personnel.
- Submit your problems to WALKER engineers for successful solution.

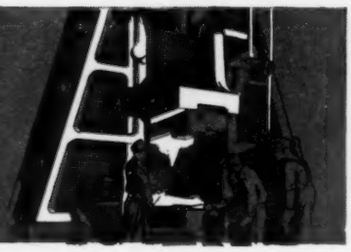
O. S. WALKER CO., INC.

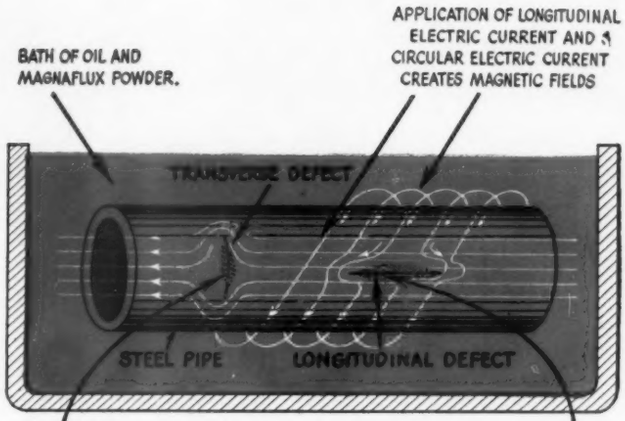
100 ROCKDALE STREET - WORCESTER, MASSACHUSETTS

Makers of Rectangular, Swivel and Rotary Magnetic Chucks. Also Permanent Chucks.

STANDARD ENGINEERS NOTEBOOK

CALOL RPM




BATH OF OIL AND MAGNAFLUX POWDER.
APPLICATION OF LONGITUDINAL ELECTRIC CURRENT AND CIRCULAR ELECTRIC CURRENT CREATES MAGNETIC FIELDS
TRANSVERSE DEFECT
STEEL PIPE
LONGITUDINAL DEFECT

CRACK PRODUCES LEAKAGE IN FIELD WHICH ATTRACTS AND HOLDS MAGNETIC PARTICLES OF POWDER, INDICATING DEFECTS. DIAGRAM ILLUSTRATES THE MAGNAFLUX WET METHOD OF STEEL INSPECTION

Water-white oils speeds magnaflux process

In the Magnaflux wet method of inspection to detect surface and sub-surface cracks and other defects in steel, Standard Base Oil C is recommended by the Magnaflux Corporation as the carrier for the Magnaflux paste and also, as the rinse.

It is used in both the continuous and the residual system. Standard Base Oil C is a clear, neutral oil so completely refined that it is water-white in color. All objectionable odors have been removed.

With all impurities removed, Standard Base Oil C does not leave an oily film on parts. It evaporates readily, leaving a distinct powder pattern at defects. A minimum amount of mixing suspends either Magnaflux Paste No. 7 Black, Pastes Nos. 9 and 9a, Red, or Paste No. 10 Magnaglo, in Standard Base Oil C. Most operators use 10 gallons with one to two-and-a-half pounds of red or black pastes, and 10 gallons with one to four ounces of No. 10 Magnaglo.

Solvent cleans metal fast and safely

The economical evaporation rate of Standard Thinner No. 325 has solved for many operators the problem of efficiently cleaning machinery, motors and metal parts of all types. It is water-white — a straight run, uncompounded product made from the heart-cut of selected crude stocks.

Standard Thinner No. 325 is especially suitable for cleaning precision parts. It has a faster final dry than most solvents generally used for this purpose, and leaves no residual oily film, thus speeding up production. Yet it is as safe as slower drying solvents since its flash point is over 100° F.

Because of the importance of selecting different petroleum solvents to obtain maximum efficiency in various operations, Standard of California manufactures a complete line that meets the specific needs of practically every industry.

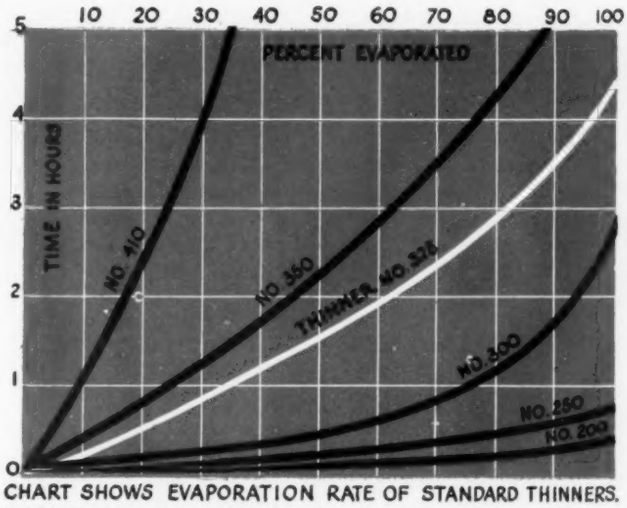


CHART SHOWS EVAPORATION RATE OF STANDARD THINNERS. 5 GRAM SAMPLES IN OPEN DISHES. ROOM TEMPERATURE 72-74°F

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

RED-E-TOOLS

SAVE MONEY
SPEED PRODUCTION
SAFEGUARD PRECISION

RED-E
HIGH SPEED CENTERS

Outlast and outperform ordinary centers many times over.

Examine this Red-E High Speed Center carefully. Note the generous proportion of High Speed Steel ...full diameter and with ample extra metal for many regrinding operations. High speed tip is electric butt flush welded to chrome steel shanks to give you a top quality tool throughout with extra service value built right in. Top quality centers are a small but mighty important investment. Write today for Red-E High Speed Center Bulletin No. A-46.

THE READY TOOL COMPANY
IRANISTAN & R. R. AVENUES
BRIDGEPORT, CONNECTICUT

OTHER RED-E PRODUCTS YOU SHOULD KNOW...

CEMENTED CARBIDE TIPPED LATHE & GRINDER CENTERS with the RED-E Safety "Life Line"

HIGH SPEED STEEL CENTERS

RED-E NEW DEPARTURE BALL BEARING CENTERS

RED-E STYLE X LATHE TOOL with the Tool Steel Bearing

MILLING MACHINE & FACE PLATE DOGS

GRINDER DOGS

RED-E-TOOLS

Bulletins on any or all of these Products on request.

Almond
Drill Chuck

The Pioneer

Almond Three-Jaw Drill Chucks were Pioneers in their field—the first to be placed on the market. They have formed a necessary part in the logical procedure of machine developments over the past seventy and more years.

Almond Drill Chucks are made in types and sizes *to fit all machine tools and portable drills.*

Write for complete details

T. R. ALMOND MFG. CO.
ASHBURNHAM, MASS., U. S. A.

The Original Manufacturers of Drill Chucks

KOEBEL

DIAMONDS
For Thread Grinding Tools
DIAMONDS
For Wheel Dressing Tools
DIAMONDS
For All Industrial Purposes
DIAMONDS
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ABRASIVE
ACCURACY BOOSTS PRODUCTION

No. IG INTERNAL GRINDER
No. 34 VERTICAL SPINDLE SURFACE GRINDER
No. 1½ HAND FEED SURFACE GRINDER
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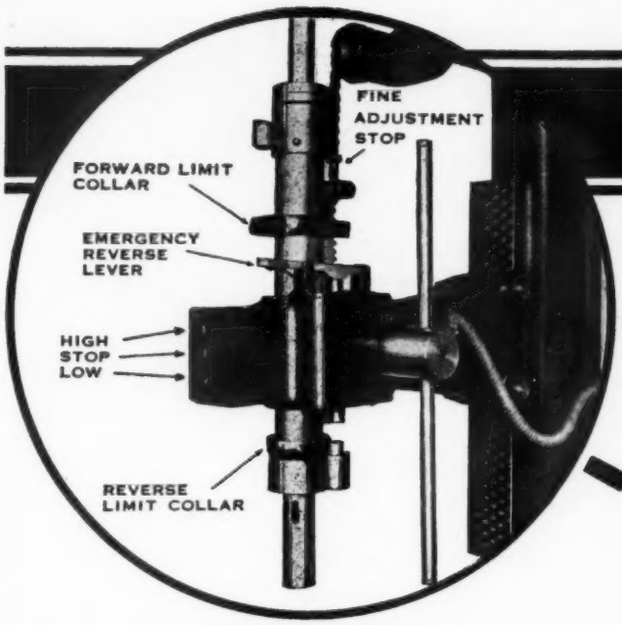
Look for Our Full Page Advertisements

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND



Avey FEATURE No. 1

THE Avey TYPE MA-6

AVEY-MATIC POWER FED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

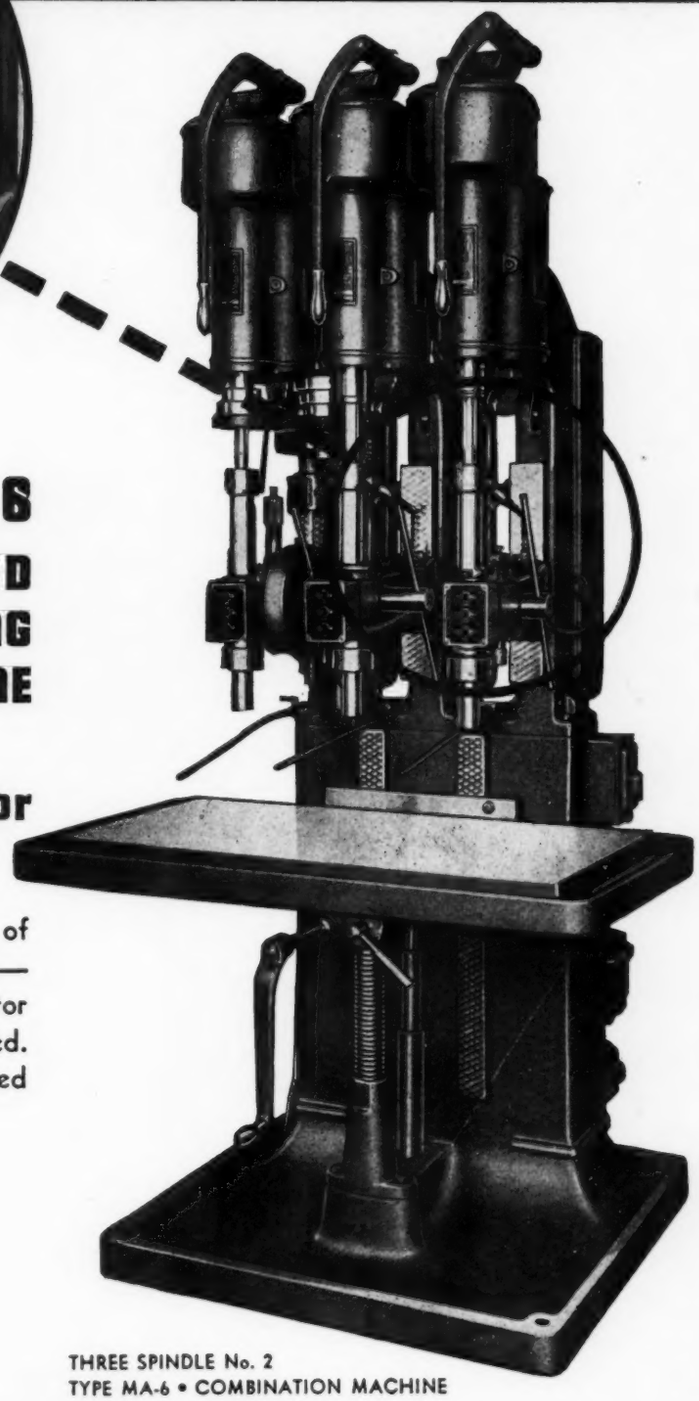
features

hand feed reversing motor for tapping

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed. The natural motion of the spindle sleeve is used to control the reversing of the motor.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.



THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

Avey DRILLING MACHINES

HERE IT IS!

SUPER'S NEW REAMER WITH FLUTE LONG CARBIDE TIPS

Supplied in sizes from 5/16" to 1½" diameter, and prices at our regular solid Reamer list plus 15%.

You will find the Super FLUTE LONG CARBIDE TIPPED solid reamer gives you finer finishes, as scoring and galling due to worn flutes is eliminated. This is particularly true when reaming in Cast Iron and other abrasive materials. Grind time in the tool room will be cut down and the life of the tool in general is greater.

Try some now . . . Check performance and cost against that of older type Carbide reamers.

CARBIDE TIPPED FULL LENGTH FLUTES

LASTING PRECISION

LESS TIME IN TOOL ROOM

MORE GRINDS PER TOOL

FASTER PRODUCTION

MORE INSPECTION O. K.'s

Specify
SUPER
CARBIDE-TIPPED
TOOLS

★

For Turning, Facing, Reaming, Milling, Forming, Spot Facing, Boring, Grooving, Grinder Rests, Wear Parts, Counterboring, Shaving, Centers, and Special Purposes.

SUPER TOOL COMPANY

Carbide Tipped Tools

21650 Hoover Rd., Detroit 13, Mich. 4105 San Fernando Rd., Glendale 4, Cal.

Talide
(TUNGSTEN CARBIDE)

Performance!

OVER

3,000,000

Impressions from one **TALIDE DIE**

TALIDE DIE NIB WEIGHING 100 LBS.

Here's a cold forming job on alloy steel forgings 4¼" dia. x 15⅝" long which requires more pressure and generates greater friction than steel dies can take in one operation.

By replacing steel with a Talide Tungsten Carbide Die, the projectiles were swaged in one operation. Two operations were needed with steel dies. After three million impressions, the smooth, highly finished large Talide Die needed no redressing. And in each of the three million, the operators reported complete elimination of galling, scratching and pick-up.

Talide Dies can be used for any cold working operation where steel dies wear out too fast or on applications too severe for steel dies. Metal Carbides make Talide Dies in all sizes up to 24" diameter, I. D.

Complete information on TALIDE Tungsten Carbide Dies is given in Bulletin 43-WP . . . write for a copy.

TUBE MANDREL

DRAWING DIES (For Wire, Tubing and Bar Stock)

POWDER METALLURGY DIES (For Compacting Powdered Metal and Materials)

TALIDE METAL MEETS EVERY REQUIREMENT

BLANKING AND FORMING DIE (For Stamping Lamination Discs, Metals, Plastics, Paper)

SHEET METAL DIES (For Deep Drawing Metal Products)

HEADING AND EXTRUSION DIES (For Shaping and Sizing Bolts, Nuts, Screws, and Rivets)

SWAGING DIES (For Forming Solid and Tubular Shapes)

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING . . . HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

15% to 30% FASTER WELDING

with 30% to 35% less current

PLUS

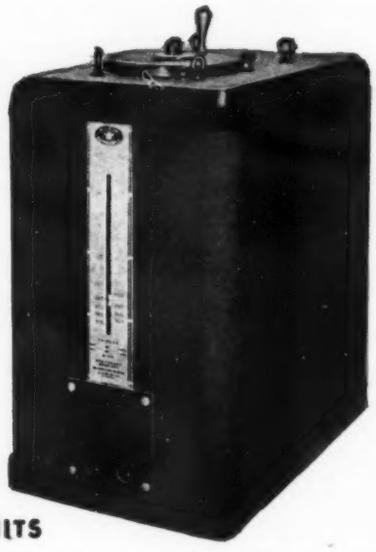
1 Improved Weld Quality. Better welds are assured with the Wilson AC "Bumblebee" Arc Welder because arc magnetic disturbances are completely eliminated. Thus, it is easier to control the molten pool, and produce sound, uniform welds—even in corners and tight spots.

2 Electrode Savings. By virtually eliminating "arc blow", the "Bumblebee" makes possible important savings through increased electrode deposition. Also a higher amperage can be used than is practical with DC welding. For this reason, the use of larger electrodes is possible, resulting in further important savings in stub ends.

3 Low Cost Operation. Economy is an outstanding feature of the "Bumblebee". Its greatly improved power factor eliminates the penalty charge of useless current lag, and permits the operation of more welders from existing feeders without causing an overload. Furthermore, savings on installation costs are assured through the use of smaller primary cables, line switches and fuses.

4 Low Maintenance. Low up-keep is virtually guaranteed with the "Bumblebee" because there are no rotating or moving parts except the cooling fan to wear, or require replacement.

Made in 200, 300, 500, 750 and 1000 ampere sizes, there is a Wilson "Bumblebee" to fit every need. Ask your nearest Airco office for catalog—or write Dept. A. M. Air Reduction, General Offices: 60 East 42nd Street, New York 17, N. Y. In Texas, Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas. Represented Internationally by Airco Export Corporation.



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OFFICES IN ALL PRINCIPAL CITIES AIRCO

WILSON

"Bumblebee"

A.C. **ARC WELDERS**

with the penetrating, stinging arc

A COMPLETE LINE OF A.C., D.C. AND GAS-ENGINE DRIVEN UNITS

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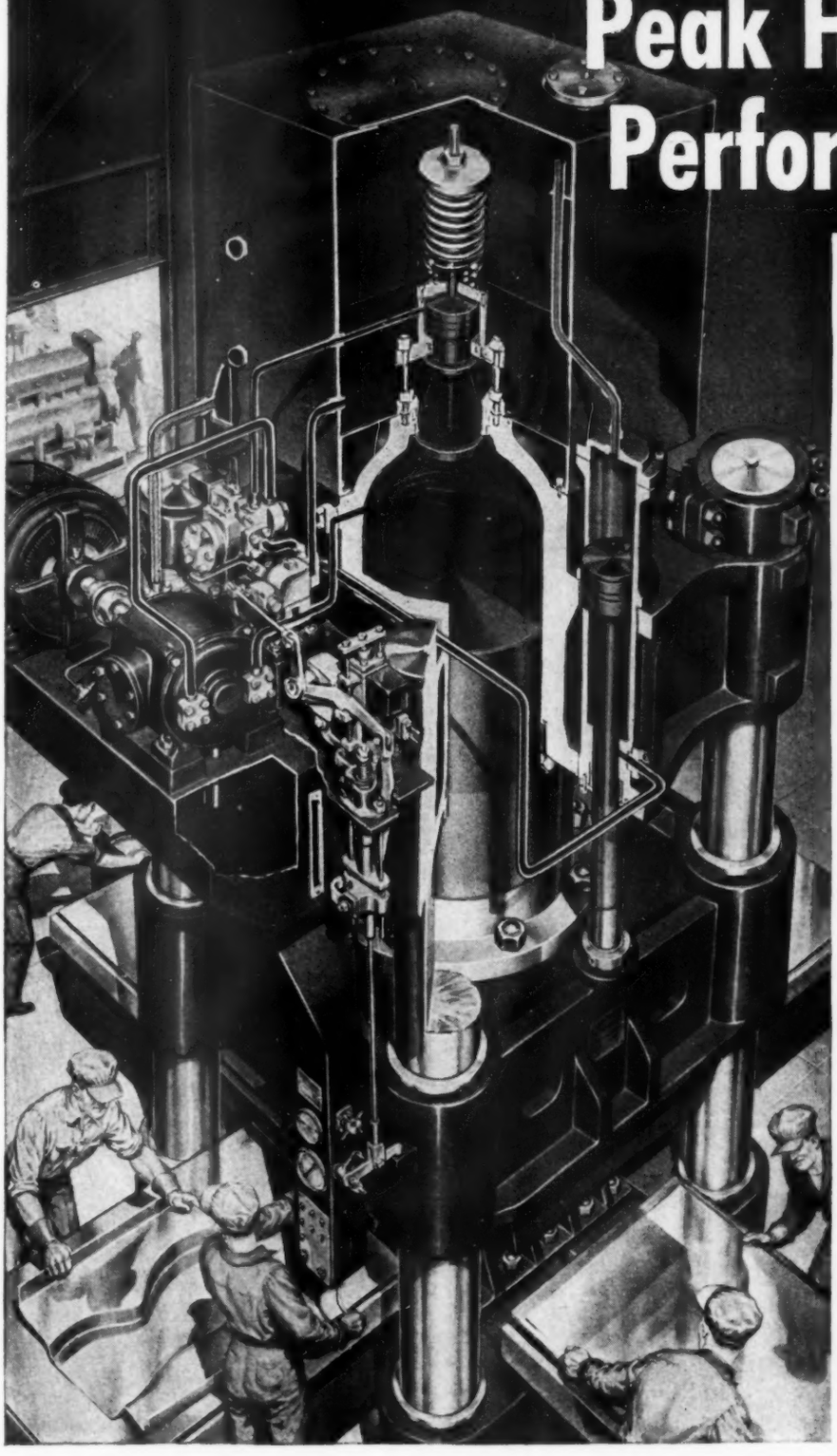

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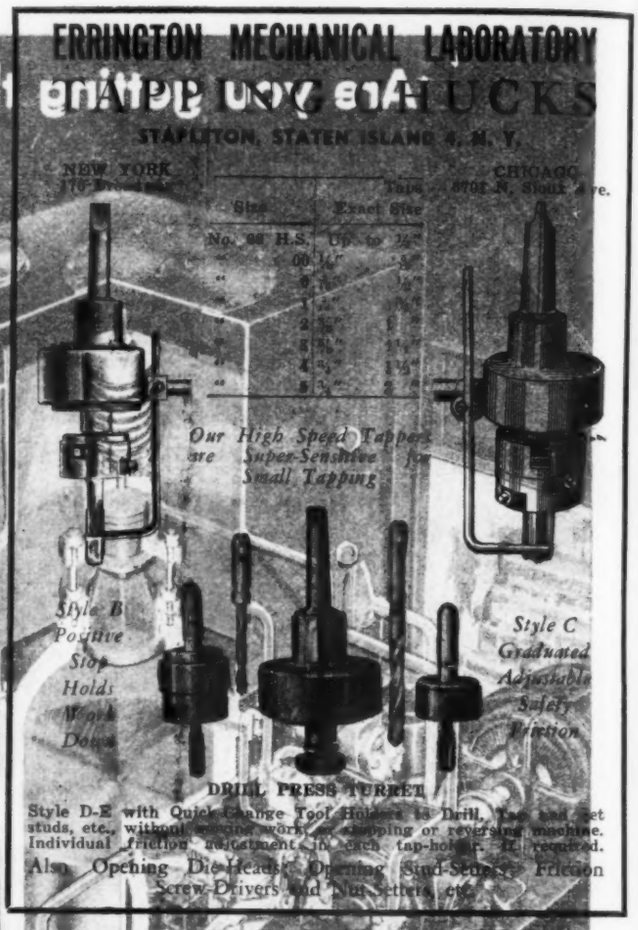
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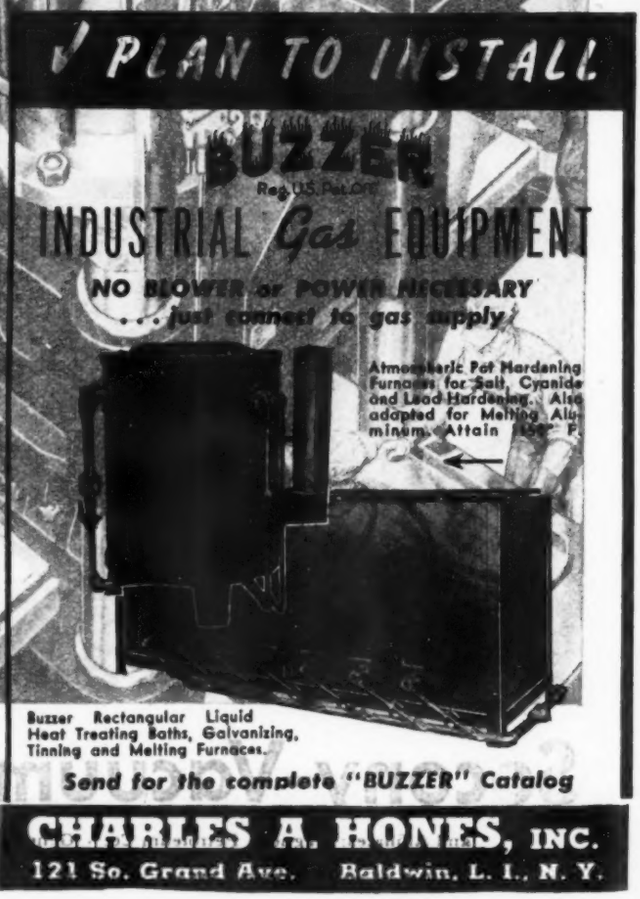
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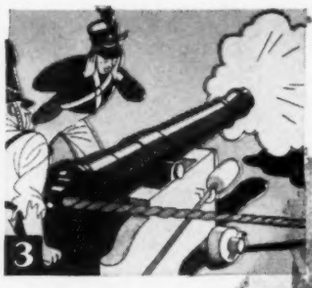
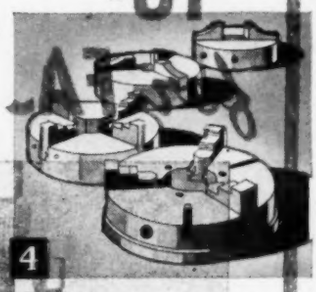
First you've gotta know what a chuck is

Chucks hold tools or work that are in motion.

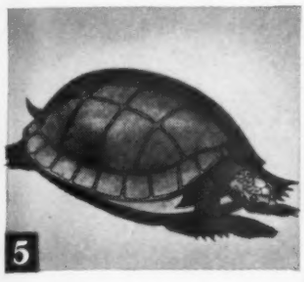
Chucks owe their origin to the ancient potter's wheel.



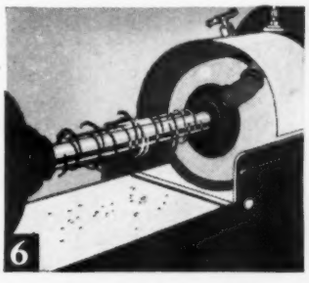
First chucks were used for making cannon in War of 1812.



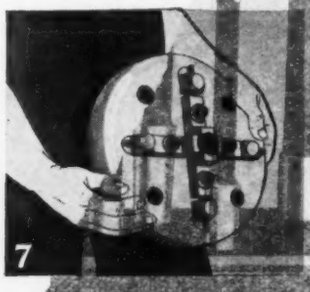
There are many kinds of chucks. Here are some in common use.



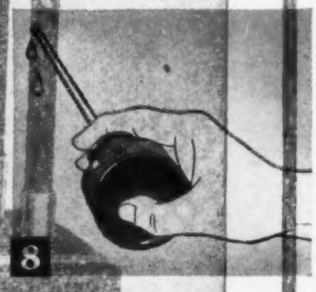
Many chucks are too "slow" for modern high-speed production.



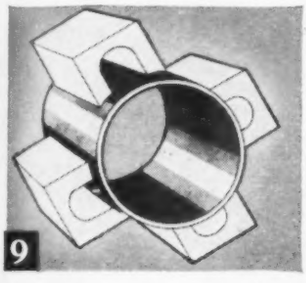
Other chucks aren't positively true —lack hair-splitting accuracy.



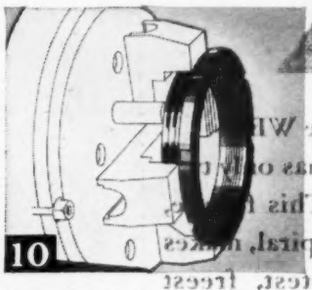
New and better is the amazing Woodworth Diaphragm Chuck.



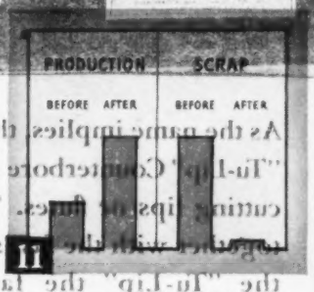
Jaws fasten to diaphragm which flexes like bottom of oil can.



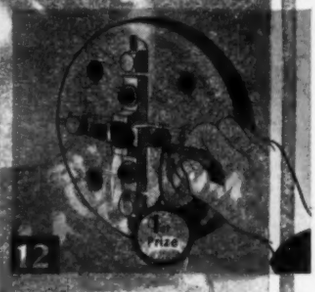
Thin-walled parts won't distort in machining to close accuracy.



Large, heavy parts can be processed with fine precision.



Steps up production 2¼ times—scrap practically eliminated!



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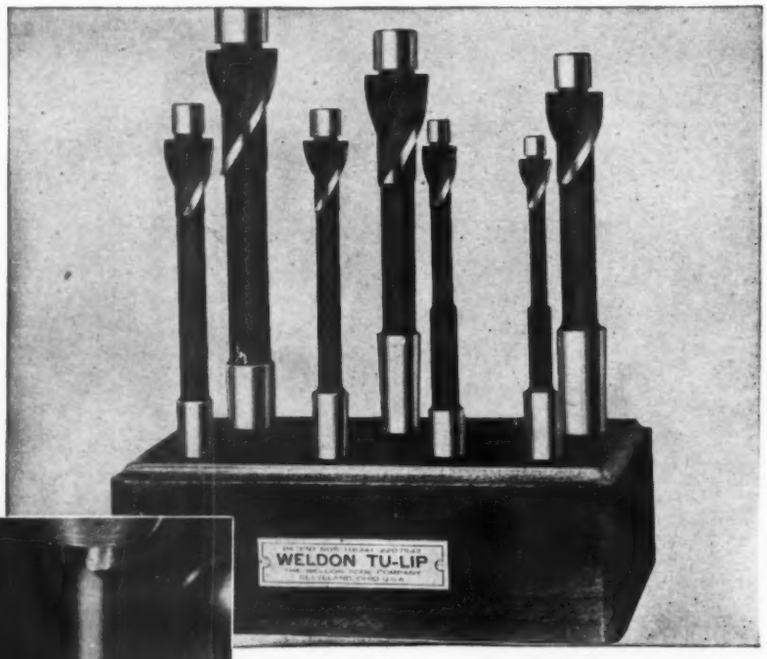

As the name implies, the WELDON "Tu-Lip" Counterbore has only two cutting lips or flutes. This feature, together with the fast spiral, makes the "Tu-Lip" the fastest, freest cutting counterbore on the market.

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8. What Job Details Repeat?
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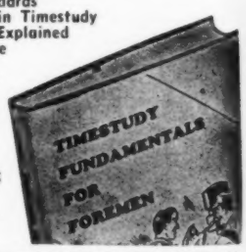
10. Be Sure to Explain Timestudy
11. Incentive Plans Explained
12. You Can Improve Methods
13. How Your Job Changes
14. Are You Looking Ahead?



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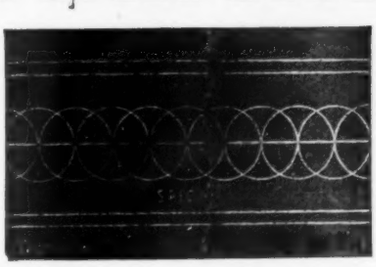

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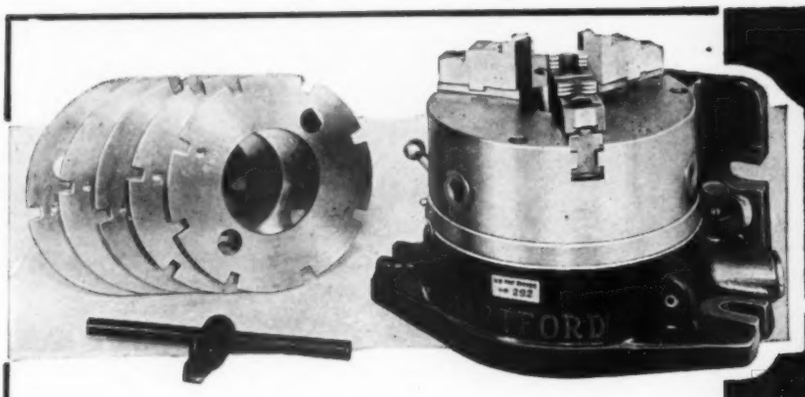

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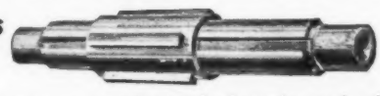

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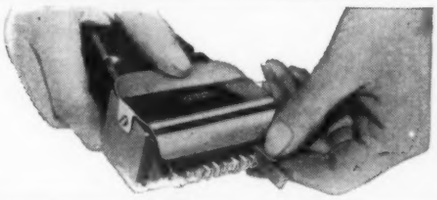

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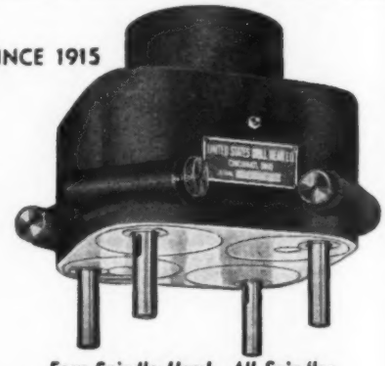

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Niagara No. 7A Inclinable Press, 60 Ton, Dual Control, Motorized.
Two Niagara No. 4 Gang Punch Presses, 20 Ton, 1 Stroke, Motorized.
Two Ferracute P1 Motorized Presses, No. 17529, 15 Ton, 1½ Stroke.
5 Ton Air Pressure Press.
Hilles and Jones No. 3 Double End Twin Press, 32" Throat, Motorized.
Ferracute P2 Bench Press, 25 Ton, Motorized.
Niagara No. 1¼ Inclinable Motorized Press.
Robertson Motorized Press, 1½ to 4½ Stroke.
Minster 20-1 Notching Press, 32" Throat, 15 Ton Pressure, Slide Adjustment, 1¾ Motorized.
Standard No. 1C Motorized Press 955.
Famco No. 15 Kick Press.
Niagara 56 Press, 3½ Stroke, 19944, 56 Tons, Motorized.
3 Ton Air Press.
Niagara Notching Press, 18" Throat, Motorized.
Niagara No. 43 Punch Press, 13444, 20 Ton, 8" Die Space, 1" Stroke, Motorized.
Motorized Horn Press, 3½ Stroke.
Acheson Double End Motorized Press, 4" Stroke.
Niagara No. 43 Punch Press, 14299, Motorized.
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Taylor Winfield 150 KVA Thyratron Continuous Seam Welder with complete control Panel, 18245, 15170 with cabinet and panel control.
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Taylor Winfield 75 KVA Seam Welder, LSC 18-60 DKD, No. 40661, cabinet and panel control.
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Taylor and Winfield Spot Welder, 7½ KVA-41287A.
Taylor and Winfield Type C18 Registered, 7½ KVA, 41289A.
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Flame Cutting Machine, Swing Type.
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Acetylene Cutting and Burning Outfit.

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Niagara 12" x 48" Gap. Shears, Heavy Duty, M.D.
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Niagara No. 160 Motorized Shear, 16 Gauge Cap. S. No. 37375.
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Two Chicago Vitreous Enamel Co. 5' x 10' Oil Fired Carborundum Enameling Furnaces with Fork and Timing Instruments, Automatic Control.
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24" Heavy Duty Steptoe Shaper, Motor Drive, Universal Table and Viso, Serial 294, 10 H.P. A.C. Motor, 220/440/60/3.
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Safety Co. Surface Grinder 18" x 6.
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Pratt & Whitney Slotter 18" Bend, 6" Stroke, 19" Graduated Rotary Table.
Porter Cable 7" Shaper, Type A 57, Motorized Oil Pump and Filter.
22" x 8 Putnam Engine Lathe.
South Bend 9" x 4½' Quick Change Bench Lathe, Model A, Motorized.
Starret 6" Power Hack Saw.
Boice Crane Helmet Head ½ Electric Bench Drill, Motorized.
Stanley Electric Bench Grinder, Double End.
Atlas 10" x 4' Bench Lathe, Motorized.
Delta Electric Bench Drills.

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60x48 Steel Ball Mill Tumblers, Porcelain Lined, 1200 Lbs.
54x42 Steel Ball Mill Tumblers, Porcelain Lined, 1000 Lbs.
36x45 Steel Ball Mill Tumblers, Porcelain Lined, 400 Lbs.
27x27 Steel Ball Mill Tumblers, Porcelain Lined, 100 Lbs.
Two 16x20 Steel Ball Mill Tumblers, Porcelain Lined, 25 Lbs.
Motorized Mixing Mill.
Motorized Paint Mixer.
Pressure Tanks and Paint Containers.

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Additional Auction Ad on page 235

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We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

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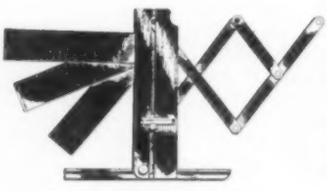

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We are seeking some firm or factory to manufacture a very practical and salable instrument to be used in all kinds of building purposes, or some Tool or Die makers to make the necessary dies.

Closed to carry in pocket

Cut of instrument, known as "COMPUTING SQUARE & RAFTER GAUGE" is herein shown. Patented and copyrighted.

Potential sale of several hundred thousand to Contractors, Cabinet Makers, Carpenters, Sheet metal workers and Manual Training Schools on first introduction on the market and eventually lead up to sale of million or more.

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EXPERIENCED CRAFTSMEN

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ON CONTRACT BASIS
TO YOUR SPECIFICATIONS

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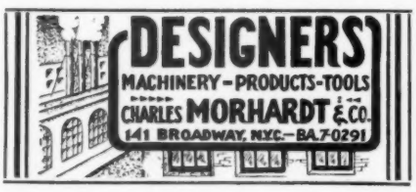

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(Makers of J. & S. Radil & Angle Dressing Tools)

Additional Contract Work Ads on page 235

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ON CONTRACT BASIS EXACTLY

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POSITIONS VACANT

WANTED ESTIMATOR and tool designer, experienced in the designing of jigs, fixtures, dies and special machinery. Also should be experienced and capable of estimating this type of manufacturing work. This position can be considered as permanent with an old well established tool plant, location Ohio. Should you have this ability and experience write, giving full background as to your experience, education, former positions held, compensation. P-516, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINE LATHE manufacturer requires the services of an experienced man to assume full charge of engineering and manufacturing operations. Please give complete information covering your experience, ability, and references. A fine opportunity for the right man. P-518, American Machinist, 330 W. 42 St., N.Y. 18, N.Y.

WANTED: ASSISTANT Shop Superintendent with practical machine shop experience as a machine operator, knowledge of shop mathematics, layout and setup work. Requires knowledge of modern shop control, routing, operating methods, also methods of cutting metals and the supervision and direction of men. Location: Fox River Valley, Wisconsin. P-530, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: PRODUCTION Manager, Drop Forge Plant. Familiar with scheduling, planning, and production. Location East. Give full particulars, age, education, positions held, salaries earned, references, salary expected, enclose picture. P-532, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED AT once by modern progressive plant engaged in the manufacture of electronic devices and radio receiving tubes: First-class machine designers. Five to ten years experience necsary. Plant located in central Pennsylvania. Interview at company's expense. Permanent positions. Give complete background as to education, experience and earnings. P-546, American Machinist, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER: Old established company has opening for electrical engineer with an E. E. degree, and considerable experience in installation and operation of industrial machinery. Excellent future possibilities. Give complete details of personal qualifications and work history in letter of application. P-547, American Machinist, 330 W. 42 St., N.Y. 18, N.Y.

PLANT SUPERINTENDENT: for small, expanding job and production machine shop in Cleveland area. In first letter give education, experience showing dates, age, salaries received, salary expected and personal data. P-548, American Machinist, 330 W. 42nd St., N. Y. 18, N. Y.

WANTED: PLANT Manager or Asst. Plant Manager for metal stamping business. Must have production and mechanical experience. P-549, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

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SALARIED POSITIONS $2,500-$25,000. Reconversion is creating lifetime opportunities now. This thoroughly organized confidential service of 35 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

GRADUATE MECHANICAL Engineer, age 29, desires "career" position in design, product development, or project engineering. Offers 7½ years experience. Now in responsible suprvisory position rquiring creation, design and production liaison of precision equipment for hydraulic division of company employing approximately 2500 people. Unusual educational background including Tau Beta Pi membership. PW-540, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WORKS MANAGER, plant manager general supt. Technically trained mechanical and industrial engineer. 24 years manufacturing light and heavy precision machine tools, diesel engine and aviation specialties, electric motor and equipment for leading companies. 8 years engineering capacities. 16 years in charge of manufacturing. An inherent mechanic and engineer experienced in using modern methods, machines, tools, and systems in all manufacturing department from purchase of material to shipment of product. Jobbing lots and line production. Good records for results in increasing production, reducing costs, efficient organizations and handling of labor relations. 44 years old. Immeriately available. PW-541, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WANTED MACHINE DESIGNER

Exceptional opportunity for young machinery designer 30-35 years old in company established over 60 years with reputation for building high quality, labor-saving machinery. Thorough knowledge of cams and tool designing for interchangeable parts necessary. Company located in Central Connecticut. Write fully giving details of education, experience, and salary requirement.

P-523, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

Die man capable of supervising, designing and building all types of medium size dies, including lamination and progressive dies.

Must be familiar with up to date methods. This is an old well established Company located in Northern Ohio.

Give full particulars of previous employment, compensation expected in first letter. Confidential.

P-523, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

POSITIONS WANTED

MANAGER HEAVY machinery, plate and structural work. Production, labor relations, engineering, sales. Resourceful, leader and organizer. Top record. Best references Engineering dgree. Age 39. PW-534, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SALES ENGINEER: available having engineering and shop background. Experienced in sales machine tools, perishable tools and engineering service. Pleasing personality, tactful, aggressive. Excellent sales correspondent. No objection location or extensive traveling. PW-550, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MACHINE DESIGNER: Twenty years experience design, development machine tools, single purpose machines. Seeks position designer or chief engineer with small or medium size concern. Competent, well qualified. Locate anywhere. Excellent references. PW-551, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

SALES ENGINEER: 30 years experience as designing, manufacturing, plant executive and tool-die maker, wants position with firm manufacturing machinery, toys, household commodities. Will go anywhere. PW-543, American Machinist, 330 W. 42nd St., New York 18, N. Y.

CHIEF ENGINEER: Available, 40 years old. 19 years' experience with tool and product design, routing, plant, management, etc., on high production precision mechanical products. Salary $10,000. PW-552, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

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(Continued on opposite page)

WANTED MECHANICAL ENGINEER

With three to five years' experience in building and maintenance of special machinery where close tolerances must be maintained. Shop experience essential.

ANSCO
Binghamton, N. Y.

WANTED—MACHINE DESIGNER

Experienced on special or paper working machinery. Excellent opportunity for permanent position. Location Philadelphia area. Please give complete details, age, experience, etc.

P-500, AMERICAN MACHINIST
330 West 42nd St. New York 18, N. Y.

WANTED

Foreman for small Machine Shop located in Northwestern Pennsylvania. Must have had Machine Tool experience. Write giving age, experience, starting salary expected and when available.

P-527, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

WANTED SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-410, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

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Our client, an established manufacturer, wants new products or new ideas that might be developed into new products.

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Propeller Division CURTISS-WRIGHT CORPORATION
JANUARY 15, 1946 — 10 A.M.

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Combined in ONE AUCTION

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Included in auction: HEALD #72A3 & #75 INTERNAL GRINDERS: HEALD #52 CYLINDER GRINDER; BIRDSBORO 1300 TON HYDRAULIC PRESS BROACHING MACHINE, HYD. #3L & #3½L; WARNER & SWASEY #3A UNIV. TURRET LATHE; 4 WARNER & SWASEY #4A UNIV. TURRET LATHES; 10 FOSTER FASTER-MATIC LATHES #2F & #2FU; 9 POTTER & JOHNSON TURRET LATHES #5D2-6C-6D; 10 GEARED HEAD LATHES, Lodge & Shipley, Boye & Emmes, Monarch, Seb. & R&M 10x5; 18x5; 18x96; 18x10; 20x14; 22x15; 18x27x6' Gap; MILLERS, THREAD, 11, 6x36; 12x24 & 12x36; MILLERS, VERT. CLEVE #2½, Becker #c #6; 2 EXCELLO #35 THREAD GRINDERS; 3 GLEASON #12 GEAR GENERATORS; 2 GLEASON GEAR GRINDERS: LANDIS, NORTON & CINCIN. PLAIN & UNIVERSAL GRINDERS 12x28; 14x36; 10x36 (5) TOOL & CUTTER GRINDERS; THOMPSON 12x32x48 SUR. GRINDER; 8" ROTARY GRINDER; TAP, CHIP, DRILL, CAM, TOOL & ELECTRIC GRINDERS, 4' RADIAL DRILL, Bench & Floor Drills, ELECTRIC FURNACES 30, 60 & 72 K.E. Temp. & Nitriding Sand Blast, Shot Blast, Arbor Presses, Welder Foot Shear, Buffing Lathes, Plating Tanks, Quenching Tanks, Laboratory & Photographic Equipment, Degreaser, MULTIPLE SPINDLE DRILL; HALL PLANETARY MILLERS, #d, NIBBLING MACHINE PROFILERS, PIPE MACHINE, BELT SANDER, SAWS: Landis 14x36''' Model C Univ. Hyd. Grinder; HEALD #72A3 Plain Internal Grinder; 3 DELTA 14" Motor Driven Drills; 2 WARNER & SWASEY #4A TURRETS 12½" hole; 3 CINCINNATI HYDRO-MATIC PLAIN MILLERS; CINCINNATI BICKFORD 4' RADIAL DRILL; BOYE & EMMES 18x78 GRD. HD. LATHE; BEATTY #7 S.E. PUNCH; 3 LEES BRADNER THREAD MILLERS; HAMMOND 14S TOOL GRINDER; CIN #2 T&C GRINDERS; ELEC. GRINDERS; DRILLS; FOOT SHEAR; ROLLS, BRAKE WELDER; LAB & PHOTOGRAPHIC EQUIPMENT, etc.

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Additional Auction Advertisement on page 231

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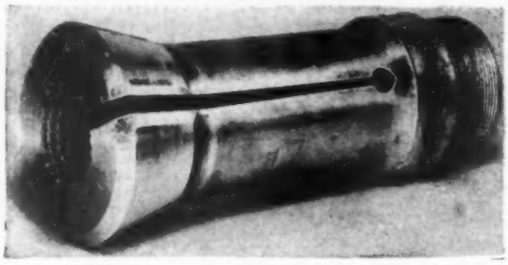

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Wilson No. 37N Floor Type Arbor Presses; 3 ton capacity.

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Clark 3 H.P. Floor Type Double End Grinders for wet and dry grinding.

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48"x48"x16' Sellers Planer, 4 heads
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1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.

1—#515 National Acme 1⅝" 4-spindle Automatics, complete.

2—#55 National Acme 1⅝" 4-spindle Automatics, complete.

1—#2G Brown & Sharpe Automatic.

1—#1 Brown & Sharpe Automatic, old style.

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

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Bickford 4-spindle Rail Drill, #4 M. T.
Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Woodward & Rogers, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.

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3' 9" column Cincinnati-Bickford.
3' 9" col. American, S.P.D.
3' Dreses, 10" rd. col. QCG., M.D.
5' Arm 13" Rd. Col. Cinn. Bick, air clamp.

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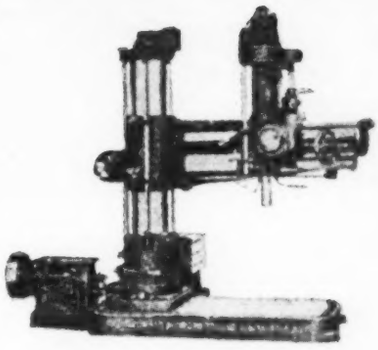
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
#11 Brown & Sharpe Plain Cylindrical.

Blanchard Grinder #16, 30" dia. Magnetic Chuck, 25 HP 3-60-440 V. Motor.

3—#2 Cincinnati Centerless Grinder.

Pratt & Whitney Vertical Surface Grinder, 14"x36" with 10"x36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

LATHES

14x6 Pratt & Whitney semi—Q.C.G.
16" Warner & Swasey Fox Brass (2).
16" Dreses Fox Brass.
Putnam 26x12 Heavy Q.C.G., arr. for M.D.
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14x6 Hendey Toolroom Lathe, G. H., M.D.
14x8 LeBlond Toolroom Lathe, cone drive.
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P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2, #3 Kempsmith Plain Millers.
#2½, #3 LeBlond Universal.

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24"x24"x6' Cincinnati, 2 heads, M.D.

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200 ton A.C.F. Hydraulic Press. Bed 24"x 36", 4-post.
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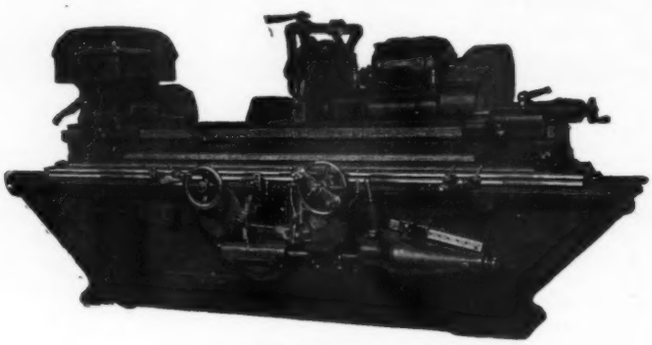

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18"x15' Accumulator 1500#
350 ton down moving ram hydraulic press 42" stroke, 28" between rods.
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No. 23 New Britain, belt
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3 spindle 1¼" Acme, belt
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3'—9" Cincinnati-Bickford Super Service, m.d. on arm, latest type
3'—11" Carlton, m.d. on arm, latest type
3' American Sensitive
3' Fosdick Sensitive
3½' Cincinnati-Bickford Plain
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4'—11" American Hole Wizard, m.d. on arm, latest
4'—13" American Hole Wizard, m.d. on arm, latest
4'—11" American Triple Purpose, m.d. on arm
4' American Triple Geared
4'—11" Cincinnati-Bickford Plain, m.d.
4'—13" Cincinnati-Bickford Plain, m.d.
4'—15" Cincinnati-Bickford Super-Service, m.d. on arm
4' Niles-Bement-Pond Semi-Universal
5'—13" Cincinnati-Bickford Plain, m.d.
5' Cincinnati-Bickford Plate Hole Driller, m.d.
5' Dreses—13" m.d.
5' Prentice Plain, m.d.
6'—15" American Triple Purpose, m.d.
6'—15" Carlton Plain, gear box on base, double base
6'—17" American Hole Wizard, with railroad type base, m.d. on arm, latest
6' Niles-Bement-Pond Semi-Universal, m.d.
6' Cincinnati-Bickford Full Universal, 15" col., m.d.
6'—16" Western Plain, m.d.
6' Reed-Prentice Plain, m.d.
7' Cincinnati-Bickford Plain, m.d.
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No. 36 HO Baker, m.d., with fixed center multiple head
22" Barnes All-Geared Self-Oiling
25" Weigel, belt
30" Rich, m.d.
32" Aurora, belt
H3 Barnes Hydram, m.d., with fixed center head

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No. ½ Avey, m.d.
No. 1 Avey Bench Type, m.d.
No. 5M—16" Fosdick, m.d., tapper
Mason Bench Type
Providence Eng. Co. Model E
Taylor & Fenn, belt
3 spindle Barr, belt
4 spindle Gardam, belt
4 spindle Kokomo, belt
6 spindle No. 3 Avey, m.d.

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No. 3 Baush, 16x30" head, 15 spindles
No. 3 Baush, 20x40" head, 15 spindles
No. 11 Pratt & Whitney, 14x9" head, 10 spindles
No. 16 Fixed Center Foote-Burt
No. 26C Fox Tapper, 50 spindles
3 spindle 12" Rockford Gang
4 spindle Foote-Burt Rail Drill
4 spindle Harrington H.D. Rail Drill

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3" Gleason Straight Bevel, m.d.
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No. 3-36", 4-36", and 8-60" Brown & Sharpe Spur Gear Cutters
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No. 36B, and 36S Gould & Eberhardt Gear Cutters, latest
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10x20" Pratt & Whitney Bench, m.d.
14"x6' Pratt & Whitney, cone
14"x6' American Geared Head, taper, collet attach., m.d.
14"x8' Pratt & Whitney, cone
14"x8' American Geared Head, m.d., taper
16"x10' Hendey Geared Head, m.d., taper
16"x10' Rahn-Mayer-Carpenter, cone
18"x8' Rockford, cone
18"x7' Hendey Geared Head, m.d., taper
18"x8' American Geared Head, m.d.
18"x8' Hendey Yoke Head, cone
18"x8' Lodge & Shipley, cone
18"x102" centers Lodge & Shipley Selective Head, m.d., taper, latest type
18"x106" centers Lodge & Shipley Selective Head, m.d., taper, latest type
18"x120" centers Monarch Geared Head, m.d., taper, latest
18"x18' Lodge & Shipley Selective Head, m.d., taper
19/38"x14'9" bed LeBlond Sliding Bed Gap Geared Head, m.d., taper, with chucks, etc., brand new
20"x13' Springfield Geared Head, m.d., taper
22"x16' centers 100 H.P. Input American Super Lathe, m.d.
23"x12' LeBlond Geared Head, m.d., taper
24"x72" Lodge & Shipley Selec. Head, m.d., taper, latest
24"x14' American Geared Head, m.d.
24"x16' American Geared Head, m.d.
25" raised in sand to 32"x12' bed LeBlond, cone
27"x16' LeBlond, cone, taper
30"x12'6" Niles-Bement-Pond Geared Head, m.d., taper
30"x13'6" Niles-Bement-Pond Geared Head, m.d.
30"x28' Niles "Time Saver", m.d., latest
36"x10' Putnam, motorized
36"x12' Wright, cone
36"x20' American Geared Head, m.d.
36"x28'6" Niles H.D., m.d., taper, latest, geared head
36"x28'6" Niles H.D., m.d., latest, geared head
36"x36'6" Niles H.D., m.d., 2 carriages, latest, geared head
42"x26' American Geared Head, m.d.

UNIVERSAL MILLING MACHINES

No. 2A Brown & Sharpe, m.d.
No. 2L Cincinnati, m.d., latest
No. 3A Brown & Sharpe, m.d.
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati H.P., m.d., with vert. attach.
No. 4B Milwaukee, m.d., with vert. attach.

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 2 Cincinnati High Speed Dial, m.d., latest
No. 2K Milwaukee, m.d., latest, dial type
No. 3B Brown & Sharpe, m.d.
No. 3B Milwaukee, m.d.
No. 4B Brown & Sharpe, m.d., in base
No. 4 Cincinnati Medium Speed Dial, m.d., latest
No. 4S Cincinnati, m.d.
No. 4 H.P. Cincinnati, m.d.
No. 4 Heavy Milwaukee, m.d., dial
No. 4K Milwaukee, m.d., dial type, latest
No. 5B Heavy Brown & Sharpe, s.p.d.

MANUFACTURING MILLING MACHINES

No. 1-18 Cincinnati Plain Auto, m.d., latest
No. 2-24 Cincinnati Plain Auto., m.d., latest
No. 4-36 Cincinnati Plain Hydromatic, m.d., latest
No. 4-48 Cincinnati Plain Hydromatic, m.d., latest
No. 34-36 Cincinnati Duplex Hydromatic, m.d., with tracer control, latest
4½x12" Pratt & Whitney Thread, belt
6x14" Pratt & Whitney Thread, belt
6x20" Pratt & Whitney Type B Geared Head Thread, m.d.
6x48" Pratt & Whitney Thread, m.d.
6x80" Pratt & Whitney Thread, m.d.
18" Cincinnati Plain Automatic, m.d.
24" Cincinnati Plain Automatic, m.d.
24"x6' Ingersoll Slab, m.d.
28" Cincinnati Plain Automatic, s.p.d.
36"x36"x14' Bement Slab, m.d.
54"x54"x10' Liberty Planer Type, m.d.
Hall Planetary Thread, m.d.
Burr Mfg., m.d.
Becker Lincoln Type, belt
Carter & Hakes Lincoln Type, belt
No. 2 and 12 Pratt & Whitney Lincoln Type, belt

HAND MILLING MACHINES

No. 3 Garvin, m.d.

SLOTTERS

10" Newton, cone
12" Bement-Niles, var. speed m.d.
15" Canada, m.d.
48" Niles-Bement-Pond Geared, var. speed m.d.
No. 1 National Acme Screw Slotter, Belt

TAPPERS

6 spindle ½" Acme Semi-Automatic Nut, m.d., latest type
No. 1 Garvin Knee Type, belt
½" Rickert & Shaffer Vertical, belt
No. 5 Webster & Perks 5 spindle Vertical Nut, belt

MISCELLANEOUS

Gisholt Precision Balancing Machine, m.d.
Kerrick Cleaner, type LOES
No. 2 Cochran-Bly Filing Machine, belt
Magnaflux Inspection Machine
Detrick & Harvey 2 spindle Profiler, belt
No. 12M Morey 2 spindle Profiler, m.d., latest type
No. 12 Pratt & Whitney 2 spindle Profiler
No. 11, 11S Cochran-Bly Saw Sharpeners
No. 1 Leighton Type Straightening Machine, m.d.
Wagner Saw Sharpener, belt
No. 1½A Standard Rotary Swaging Machine, m.d.

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3¾" CLEVELAND Model A Single Spindle Automatic Screw Machine: Two, complete tooling equip., 25 assorted collets. New in 1943.
OHIO PRODUCTION Milling Machine: With No. 50 National Taper in spindle, m. d. New in 1943.

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No. 61 1⅝" New Britain, six spindle.
16" x 33" Fay, with air chuck.

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★ **4 Ft. Canedy-Otto Radial Drill, motor spindle, 11" column, new in 1942.**
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★ **21" Cincinnati-Bickford Direct Motor Driven Drill, single spindle.**
42" Barnes, sliding head.
Allen Sensitive Drill, four spindle.
No. 11 Natco Multiple Drill, 16 spindle.
★ **No. 3 Baush Multiple Drill, 20 spindle, No. 2 Morse taper, rectangular head 20" x 40".**

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No. 6 Fellows Gear Shaper, m.d.
No. 5AC Lees Bradner Gear Hobber.
No. 12 Barber Colman Gear Hobber.
No. 5—48" Cincinnati Automatic Gear Cutter.

GRINDERS
No. 22 Heald Rotary Surface.
76" Rogers Knife Grinder, type B.
No. 72A5 Heald Plain Internal Grinder.
No. 16-26" and No. 16-30" Blanchard Surface Grinder.
No. 72A3 Heald Gagematic Internal Grinder.
No. 70 and 75 Heald Internal Grinders.
No. 13 Brown & Sharpe Universal & Tool Grinder.
10" x 36" Norton Cylindrical Grinder.
10" x 50" Norton Cylindrical Grinder.
11" x 72" Brown & Sharpe Cylindrical.
No. 2 Cincinnati Centerless.
★ **No. 3 Cincinnati Centerless Grinder, m.d.**

LATHES, ENGINE
★ **20" x 8' Sidney "Monotrol", 8 speed geared head, with taper attachment.**
24" x 10' American, g.h.
24" x 30' Lodge & Shipley, g.h.
16" x 6' Pratt & Whitney, c.d., with relieving attachment.
★ **8" x 60" Fitchburg Lo-Swing, g.h.**

LATHES, TURRET
★ **No. 4L Gisholt, 9¼" spindle, chucking.**
No. 1A, 2A, Warner & Swasey.
★ **No. 6D Potter & Johnston Automatic Chucking and Turning Machine.**
No. 3 Gisholt, g.h.
★ **42" Bullard VTL, New Era type.**

MILLS
No. 4A Brown & Sharpe Universal, spd.
No. 3B Milwaukee Plain, m.d.
No. 4 LeBlond Plain, c.d.
No. 1A Milwaukee Plain, s.p.d.
No. 0-8 Cincinnati Plain Automatic, m.d.
18" Cincinnati Plain Mfg., s.p.d.
6" x 14", 6" x 48", P. & W. Thread Mill.
4" Pratt & Whitney Spline Mill.
42" Bullard Vertical Boring Mill.

MISCELLANEOUS
No. 3 Long & Allstatter, Multiple Punch, m.d.
Schraner Crankshaft Lapping Machine, Model B.
8" x 7" Troy Vertical Steam Engine.
No. 6 Whiting Stake Riveter.

PLANERS AND SHAPERS
28" Gould & Eberhardt, s.p.d.
36" x 36" x 10' Woodward & Powell Planer, 2 heads.
★ **6" Pratt & Whitney Vertical Shaper.**

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No. 4B Marvel Hack Saw.
9" x 9" Peerless Hydraulic

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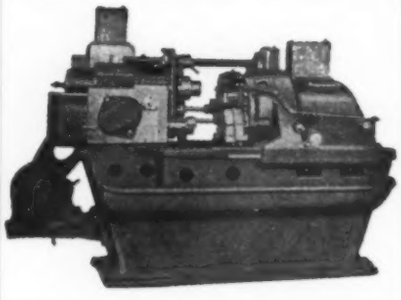

8½" X 8" GOSS & DELEEUW
CHUCKING MACHINE

Capacity 8½" in diameter x 8" long 5 chucks on turret

Maximum opening between chuck jaws 9⅝"

Minimum opening between chuck jaws 7⅝"

Maximum distance spindle nose to face of turret 23¾"

Dies and taps controlled by positive lead screw

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1—#2K Milwaukee plain milling machine
1—#3 Warner-Swasey universal turret lathe (bar feed)
1—#3 Cincinnati plain milling machine (dial type)
1—#2H Milwaukee vertical milling machine
1—#3H Milwaukee vertical milling machine
2—6" x 18" Norton (hydraulic) Surface grinders
2—#12 B&S plain auto. millers (electrically controlled)
2—#00 B&S plain automatic millers
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Machine Tools

#35 Landis Horizontal Boring Mill, floor type
36" Bullard Rapid Production Vertical Boring Mill
42" Bullard Spiral Drive Vertical Turret Lathe (1942)
36"x36"x12' Gray Planer, 2 heads
#263 2-spindle Barnes Drill
5 ft. Morris "Mor-Speed" motor-on arm Radial
#4 Cincinnati High Power Plain Miller
#5-C Becker Vertical Miller with Rotary
36"x32' American G.H. Lathe

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30"x26' Lodge & Shipley 12 speed Geared Head, M.D.
32"x35' Wickes Grd. Hd., M.D.
36"x30' Putnam Grd. Hd., M.D.
42"x16' Putnam, M.D.
36"x22' Putnam Geared D.C. M.D.

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24" BULLARD New Era Vertical, one swiveling turret head, one side head. AC or DC spiral drive.

42" BULLARD New Era Vertical, one swiveling turret head, one side head. AC or DC motor drive.

No. 1 PUTNAM Vertical Car Wheel Boring Mill, side head for hub facing and hoist. AC or DC motor drive.

100" NILES-BEMENT-POND Vertical, 2 swiveling heads, Power Rapid Traverse. AC or DC motor drive.

120" BETTS Heavy Vertical, 2 swiveling heads, Power Rapid Traverse, AC or DC.

No. 32—3¾" Bar LUCAS Horiz. Boring, Drilling & Milling Machine.

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48" x 48" x 16' INGERSOLL Planer Miller, 4 heads, M.D.

No. 4 CINCINNATI High Power Plain, Power rapid traverse table 16½" x 64". Single pulley belt drive or AC or DC.

No. 4 CINCINNATI High Power Vertical Power rapid traverse. Table 16½" x 64". Single pulley belt drive or AC or DC motor drive.

LATHES

36" x 30' LODGE AND SHIPLEY 18 speed selective geared head screw cutting engine lathe, 2 carriages. AC or DC motor drive.

42" x 36" PUTNAM Geared Head, 25' between centers. Quick change gear box. AC or DC motor drive.

48" x 20' NILES-BEMENT-POND Extra Heavy Geared Head, 11'5" between centers. Power cross and angular feed to compound rest. Semi-quick change gear, taper attachment.

RADIAL DRILLS

4' AMERICAN Plain triple purpose enclosed head drill, tapping attachment. Single pulley belt drive or AC or DC.

5½' AMERICAN Full Universal Triple Geared Tapping Attachment. Single pulley belt drive or AC or DC.

6' AMERICAN Triple purpose, plain radial, motor on arm.

GRINDERS

No. 2 CINCINNATI centerless grinder.

12" O.S. WALKER Single Stroke Surface Grinder, 12' dia. magnetic chuck and 7½ HP, AC or DC motor drive.

36" x 36" x 12' CINCINNATI Standard Planer, 2 heads on rail, power elevation to rail, AC or DC motor drive.

PLANERS

120" x 96" x 20' CINCINNATI, Rapid Traverse Planer, with 4 heads, 230 Volt DC reversing planer motor and control.

48" x 48" x 15' NILES-BEMENT-POND Heavy, 2 heads on rail and 2 side heads, 230V DC reversing type planer, motor and control.

16' x 10' x 30' BETTS Heavy, 2 heads on rail and 2 side heads, forced feed lubrication. 230 V DC reversing type planer, motor and control.

SLOTTERS

6" PRATT & WHITNEY Vertical Shaper with 20" rotary table, power feeds, tilting ram. AC or DC motor drive.

15" NEWTON Crank Slotter, 30" circular table, AC or DC motor drive.

MISCELLANEOUS

30' No. 3 HILLES & JONES Plate Edge Planer.

30' x ⅜" NBP Bending Rolls, pyramid type.

No. 2 PRATT & WHITNEY Jig Borer with 22" x 44" table.

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PRATT & WHITNEY, Model C 6x20" Thread
LEES BRADNER, No. LT Thread

TURRET LATHES

WARNER & SWASEY, No. 3, No. 4 Universal
WARNER & SWASEY, No. 1A, No. 2A

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BROWN & SHARPE, No. 0 ⅜" cap.
BROWN & SHARPE, No. 1 ⅜" cap.
BROWN & SHARPE, No. 2 1" cap.
} Wire Feed

GRINDERS

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PRATT & WHITNEY 14x60" Ver. Surface
BLANCHARD, No. 18 Surface
BROWN & SHARPE No. 5, No. 23 Plain Cyl.
LANDIS Type H, 4x12" Hyd. Plain
LANDIS Type C, 10x48" Hyd. Plain
BROWN & SHARPE, No. 1, No. 2 Universal
LeBLOND, No. 2 Univ. Tool & Cutter
TAYLOR & FENN Cutter
PRATT & WHITNEY Contour

DRILL PRESSES—High Speed

ALLEN bench type HMDV
ALLEN single spindle
ALLEN 3-spindle
ALLEN 4-spindle
ALLEN 5-spindle
ALLEN 6-spindle

DRILLING MACHINES—Deep Hole

PRATT & WHITNEY 2-spindle

PRESSES

GREENERD No. 5 Arbor
WATSON STILLMAN Hyd. Straightening
BILLINGS & SPENCER No. 2 Hot Trimming

MISCELLANEOUS

BILLINGS & SPENCER Mod. "D" 1200# cap.
BAKEWELL Precision type Tapper
PEERLESS 6x6 High Duty Metal Saw
MOREY No. 12M 2 spindle Profilers
WORTHINGTON Pump Type BH Air Compressor
DeVILBISS special assembly Spray Booth
BLOUNT 4", 6' Speed Lathes

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BULLARD 24", 36", 42", N.E. Type—M.D.
GISHOLT 42"—2 heads
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AVEY No. 3, single spindle
AVEY No. 2, 3-spindle
COLURN D-2 Upright
NATCO No. 12, multiple spindle

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BROWN & SHARPE No. 13
BROWN & SHARPE 60"x12" Spur Gear
FELLOWS No. 712
GOULD & EBERHARDT 36" Hobber

GEAR GENERATORS
GLEASON 3", 6", 12" Straight
GLEASON 10" and 15" Spiral
GLEASON 18" Bevel Gear

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NORTON 24"x240" Plain
ARTER 8" Rotary Surface
BLANCHARD #16 Vertical Surface
ARTER Automatic Piston Ring
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ENGINE LATHES
SOUTH BEND 11"x4'
LeBLOND 16"x14'; 16"x6', geared head
LEBLOND 17"x10', 17"x6' Rapid Prod.
SOUTH BEND 16"x6' cone pulley
AMERICAN 16"x8', 18"x8', 20"x 8', cone
LODGE & SHIPLEY 18"x8' geared
MONARCH 30"x10' geared; TIMKEN
LODGE & SHIPLEY 30"x26'; 2 carriages

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JONES & LAMSON 2¼"x24"
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BROWN & SHARPE No. 2
BARDONS & OLIVER 2" capacity

AUTOMATIC SCREW MACHINES
CLEVELAND ⅞", 1¼", 2-2½" Model A

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MILWAUKEE No. 3B Universal
CINCINNATI No. 3 Vertical
BROWN & SHARPE No. 3 Vertical
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SUNDSTRAND Rigid Mill; Table 60"x14½"

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GRAY 30"x30"x8'—1 head
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CINCINNATI 120"x96"x20' rapid traverse—4 heads; DC reversing motor drive
HAMILTON 42"x42"x20'—4 heads; DC M.D.
GRAY 48"x48"x16'—4 heads
GRAY 72"x48"x12'—2 heads
WOODWARD & POWELL 60"x60"x20'—4 heads

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ESPEN LUCAS No. 138 Cold Saw—12" cap.
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CLEVELAND Relieving Machine

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Boring Mill, 7" bar, floor type, MD.
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Grinder, #16 Blanchard, 26" Ck., MD.
Hack Saw, 9A, Marvel, 3/60/220 volts.
Keyseater, #4 Davis, cap. 1", MD.
Lathe, 16"x7'; 18"x8', Geared Head.
Millers, Vert. Nos. 3 & 4 Cin., MD.
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Turret Lathe, #2-G. Morey, MD.
Turret Lathe, #1 W. & S., cap. 1", MD.
Turret Lathe, 26" Libby-Int., 7½" HS, MD.

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Approx. ground 175,000 Sq. Ft., Building 40'x120'—cement floor, heating plant, Machine Tools, Small Tools, Supplies, Stock as well as Furniture and Fixtures. *Offered as going plant.* Can include name and good-will.

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Boring Mills, 36"-42"-52"-72"-96".
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Lathes, 20" to 30" Geared Head, M.D.
Press, Forging 1000 Ton United, St.-Hyd.
Planer, 36"x36"x12' Powell 4 Hds.
Planer, O. S. 60"x60"x14' D. & H., M.D.
Profiler, #13 P. & W., B.D.
Shapers, 10"-20"-24"-36".
Shaper 36" Morton, Draw Cut
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#2-F, #3-F Foster Fastermatic Hydraulic Turret Lathes, 1 yr. old.
2½" to 4" bar Horiz. Boring Mills, 1 yr. old, $6,000.00 up.
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Quick Change Gear Lathes, $125.00 up complete
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LESS THAN FIVE YEARS OLD. READY TO GO TO WORK.

1—#36 Van Norman Vertical, A.C. M.D. New in 1942.
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7—#0-8 Cincinnati Plain Automatic Millers, Rise & Fall, Motors.
1—10" x 72" Norton Type C Plain Hydraulic Grinders, A.C. Motor Drive.
3—#2-20 Kent Owens Hydraulic Milling Machines, A.C. Motor drive.
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#4A Warner & Swasey, 8" hollow spindle, A.C.M.D. Very Good.

BORING MILLS

42' Niles 2 Head Boring Mill, reasonably priced.
36" Bullard New Era Vertical Turret Lathe, S.P.D.
61" Bullard Maximill, 2 heads, Power Rapid Traverse.
10' Cincinnati Boring Mill, 2 heads, Excellent.

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27" x 16' Lodge & Shipley Geared Head, A.C. M.D. Taper
36" x 30' Lodge & Shipley Geared Head, Two Carriages, Q.C.
16" x 8' Reed Prentice Timken Bearings. A.C. M.D. Taper.
14" x 6' Hendey Geared Head, A.C.M.D. Taper.
24" x 16' American Grd. Head, S.P.D.
36" x 16' American Grd. Head, 16 speed.
36" x 36' American Geared Head, 2 carriages.
42" x 28' Putnam Grd. Head, 18 speed, 2 carriages.

MILLING MACHINES

#3 Cincinnati Vertical H.P. S.P.D.
#4 Cincinnati High Power, A.C. M.D. Rapid Traverse, Vertical.
#5 Cincinnati Rect. Overarm, Rapid Traverse, S.P.D.
#2 American Plain Milling Machine. A.C. M.D.

GRINDERS

18" x 85" Landis Crankshaft.
16" x 24" x 96" Mattison Hydraulic Surface Grinders, A.C M.D.
16CP16 Bryant Internal Grinders, A.C.M.D.
Pratt & Whitney 2 wheel, Helical Gear Grinders.

PLANERS

60" x 48" x 24' American, 4 Heads.
24" x 24" x 10' Powell Planer, 2 Heads.
56" x 56" x 36' Cincinnati, 4 heads.
84" x 84" x 22' Cincinnati 4 heads, D.C. Variable speed.

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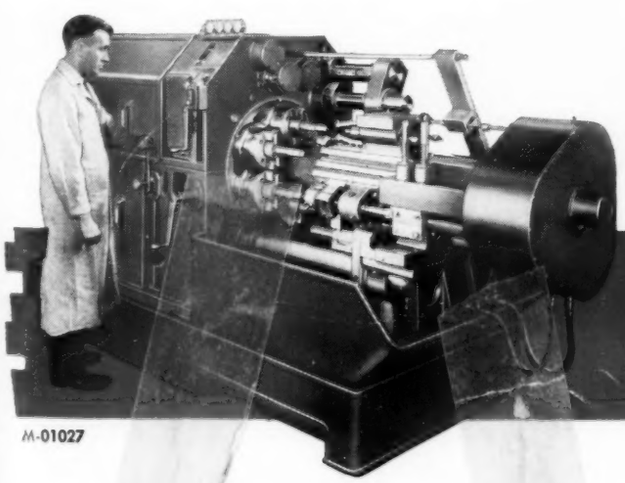

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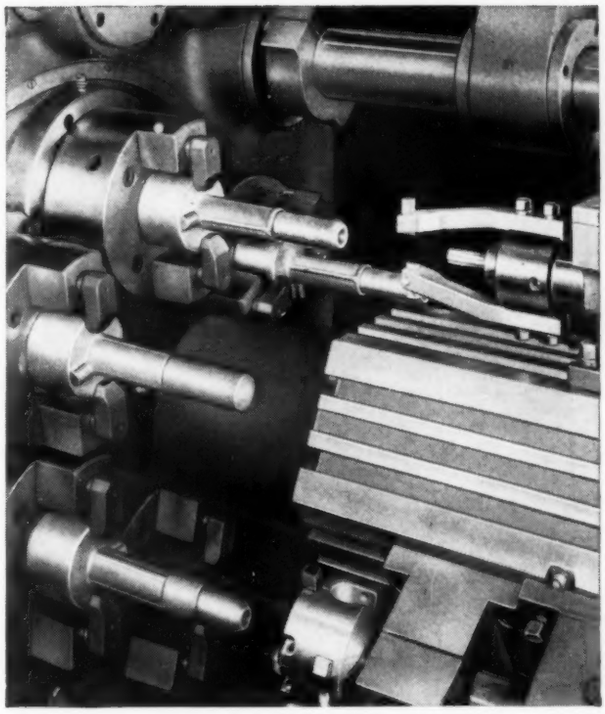
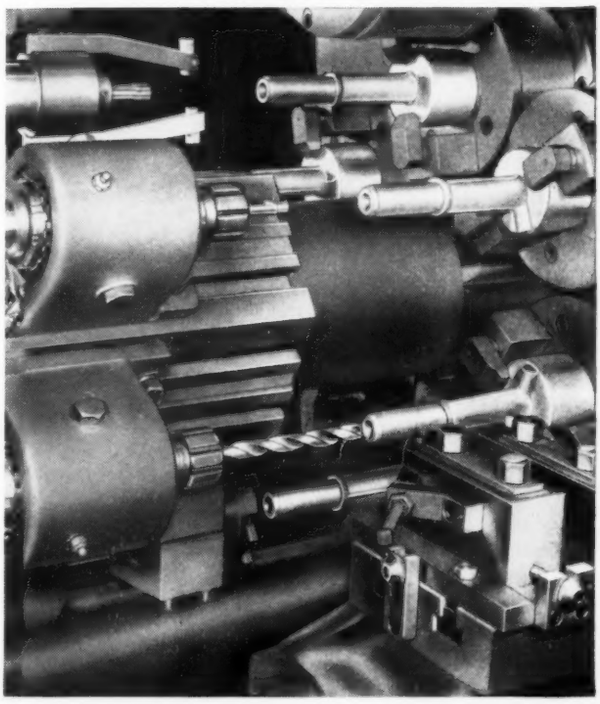


ENTIRELY OPEN END CONSTRUCTION... LOADING POSITION EASILY ACCESSIBLE



REAR VIEW: NOTE ACCESSIBILITY OF ALL TOOLS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

TIMKEN SEAMLESS TUBING

Timken Seamless Steel Tubing is made in carbon, alloy or stainless steels and has a wide range of mechanical and physical properties. This enables it to cover a multitude of applications.

While Timken Seamless Tubing is made in 219 different analyses, all of them have one thing in common - - - *unexcelled quality*. This characteristic is assured because every manufacturing step of this versatile material is closely guarded by one organization which melts the steel, rolls the billets and pierces the tubing.

In addition to offering a wide choice of excellent material the use of Timken Seamless Steel Tubing will speed the production of your products. When used in place of bar stock to make hollow cylindrical parts, it eliminates drilling, reduces scrap loss and permits faster machining speeds.

Send us a blueprint of the part you make. A member of our technical organization will be glad to make recommendations that will enable you to make your product better - - - stronger - - - faster. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.